

# Project Manual Final Construction Document Submittal

Volume 01  
Divisions 00-33

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## CHEROKEE NATION DURBIN FEELING LANGUAGE CENTER

### BID PACKAGE 01

Tahlequah, Oklahoma

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July 16, 2021

Building Demolition

Site Demolition (at building only)

Pre-Engineered Metal Building / Slab / Foundations

Rough Grading (at building only)

Under-Slab Utilities (plus 5 feet from slab edge)



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### **DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

	<input type="checkbox"/>	00 11 15	Invitation to Bid
	<input type="checkbox"/>	00 21 13	Instructions to Bidders
07-16-21	<input checked="" type="checkbox"/>	00 31 00	Available Project Information
	<input type="checkbox"/>	00 41 00	Bid Form
	<input type="checkbox"/>	00 52 00	Agreement Form
	<input type="checkbox"/>	00 61 00	Bonds
07-16-21	<input checked="" type="checkbox"/>	00 72 00	General Conditions
	<input type="checkbox"/>	00 73 00	Supplementary Conditions

### **DIVISION 01 - GENERAL REQUIREMENTS**

	<input type="checkbox"/>	01 05 00	Design Selections
	<input type="checkbox"/>	01 05 10	Exterior Design Selections
	<input type="checkbox"/>	01 05 20	Interior Design Selections
	<input type="checkbox"/>	01 10 00	Summary
	<input type="checkbox"/>	01 21 00	Allowances
	<input type="checkbox"/>	01 22 00	Unit Prices
	<input type="checkbox"/>	01 23 00	Alternates
07-16-21	<input checked="" type="checkbox"/>	01 25 00	Substitution Procedures
	<input checked="" type="checkbox"/>	01 25 00a	Substitution Procedure Form
07-16-21	<input checked="" type="checkbox"/>	01 26 00	Contract Modification Procedures
07-16-21	<input checked="" type="checkbox"/>	01 29 00	Payment Procedures
	<input type="checkbox"/>	01 29 00a	Project Cost Summary Form
07-16-21	<input checked="" type="checkbox"/>	01 31 00	Project Management and Coordination
07-16-21	<input checked="" type="checkbox"/>	01 32 00	Construction Progress Documentation
	<input type="checkbox"/>	01 32 33	Photographic Documentation
07-16-21	<input checked="" type="checkbox"/>	01 33 00	Submittal Procedures
07-16-21	<input checked="" type="checkbox"/>	01 40 00	Quality Requirements
07-16-21	<input checked="" type="checkbox"/>	01 43 39	Visual Mock-Up Requirements
	<input type="checkbox"/>	01 45 16	Field Test for Water Leakage
07-16-21	<input checked="" type="checkbox"/>	01 45 29	Testing Lab Services
07-16-21	<input checked="" type="checkbox"/>	01 50 00	Temporary Facilities and Controls
07-16-21	<input checked="" type="checkbox"/>	01 60 00	Product Requirements
07-16-21	<input checked="" type="checkbox"/>	01 73 00	Execution
	<input type="checkbox"/>	01 74 16	Clean Up (Site Maintenance)
07-16-21	<input checked="" type="checkbox"/>	01 74 19	Construction Waste Management and Disposal
	<input type="checkbox"/>	01 74 20	LEED Construction Waste Management and Disposal
07-16-21	<input checked="" type="checkbox"/>	01 77 00	Closeout Procedures
07-16-21	<input checked="" type="checkbox"/>	01 78 23	Operations and Maintenance Data
07-16-21	<input checked="" type="checkbox"/>	01 78 39	Project Record Documents
07-16-21	<input checked="" type="checkbox"/>	01 79 00	Demonstration and Training
	<input type="checkbox"/>	01 81 11	Sustainable Construction Requirements
	<input type="checkbox"/>	01 81 12	LEED Construction Requirements
	<input type="checkbox"/>	01 81 13	LEED Construction Requirements for New Construction and Major Renovations
	<input type="checkbox"/>	01 81 33	LEED Construction Requirements for Core and Shell Development
	<input type="checkbox"/>	01 81 43	LEED Construction Requirements for Schools
07-16-21	<input checked="" type="checkbox"/>	01 91 13	General Commissioning Requirements

## DIVISION 02 - EXISTING CONDITIONS

07-16-21	<input checked="" type="checkbox"/>	02 41 13	Demolition
	<input type="checkbox"/>	02 41 16	Building Demolition
07-16-21	<input checked="" type="checkbox"/>	02 41 19	Selective Demolition

## DIVISION 03 - CONCRETE

	<input type="checkbox"/>	03 01 50	Concrete Patching
07-16-21	<input checked="" type="checkbox"/>	03 10 00	Concrete Forming and Accessories
	<input type="checkbox"/>	03 15 00	Concrete Accessories
07-16-21	<input checked="" type="checkbox"/>	03 20 00	Concrete Reinforcing
	<input type="checkbox"/>	03 21 00	Steel Reinforcement (Sidewalk)
07-16-21	<input checked="" type="checkbox"/>	03 30 00	Cast-In-Place Concrete
	<input type="checkbox"/>	03 30 53	Cast-in Place Concrete (Site work)
	<input type="checkbox"/>	03 35 00	Concrete Finishing
	<input type="checkbox"/>	03 35 36	Concrete Finishing (Site work)
	<input type="checkbox"/>	03 35 43	Polished Concrete
	<input type="checkbox"/>	03 36 00	Special Concrete Finishes
	<input type="checkbox"/>	03 38 00	Post-Tensioned Concrete
	<input type="checkbox"/>	03 40 00	Precast Concrete
	<input type="checkbox"/>	03 41 00	Precast Structural Concrete
	<input type="checkbox"/>	03 45 00	Architectural Precast Concrete
	<input type="checkbox"/>	03 47 13	Tilt-Up Concrete
	<input type="checkbox"/>	03 49 00	Glass-Fiber Reinforced Precast Concrete (GFRC)
	<input type="checkbox"/>	03 52 16	Lightweight Insulating Concrete
	<input type="checkbox"/>	03 53 00	Concrete Toppings
	<input type="checkbox"/>	03 54 16	Hydraulic Cement Underlayment

## DIVISION 04 – MASONRY

	<input type="checkbox"/>	04 21 00	Masonry Veneer
07-16-21	<input checked="" type="checkbox"/>	04 22 00	Concrete Unit Masonry
	<input type="checkbox"/>	04 23 00	Glass Unit Masonry
	<input type="checkbox"/>	04 42 00	Exterior Stone Cladding
	<input type="checkbox"/>	04 42 16	Steel Supported Stone Cladding
	<input type="checkbox"/>	04 72 00	Cast Stone Masonry
	<input type="checkbox"/>	04 75 00	Adhered Masonry Veneer

## DIVISION 05 – METALS

	<input type="checkbox"/>	05 10 00	Structural Steel
07-16-21	<input checked="" type="checkbox"/>	05 12 00	Structural Steel Framing
	<input type="checkbox"/>	05 12 13	Architecturally Exposed Structural Steel (AESS)
	<input type="checkbox"/>	05 16 36	Barrier Cables
	<input type="checkbox"/>	05 21 00	Steel Joist Framing
07-16-21	<input checked="" type="checkbox"/>	05 31 00	Steel Decking
	<input type="checkbox"/>	05 31 23	Steel Roof Deck System
	<input type="checkbox"/>	05 31 33	Permanent Metal Forming
	<input type="checkbox"/>	05 40 00	Cold-Formed Steel Framing
	<input type="checkbox"/>	05 43 00	Slotted Channel Framing
	<input type="checkbox"/>	05 50 00	Metal Fabrications
	<input type="checkbox"/>	05 51 00	Metal Stairs

<input type="checkbox"/>	05 52 13	Pipe and Tube Railings
<input type="checkbox"/>	05 52 14	Ornamental & Misc. Metals
<input type="checkbox"/>	05 53 00	Metal Gratings
<input type="checkbox"/>	05 58 13	Ornamental Metal Column Covers
<input type="checkbox"/>	05 70 00	Ornamental Metal
<input type="checkbox"/>	05 73 00	Ornamental Handrails and Railings

## DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

<input type="checkbox"/>	06 10 53	Miscellaneous Rough Carpentry
<input type="checkbox"/>	06 16 43	Exterior Gypsum Sheathing
<input type="checkbox"/>	06 40 23	Interior Architectural Woodwork
<input type="checkbox"/>	06 42 23	Slatwall Paneling
<input type="checkbox"/>	06 61 00	Simulated Stone Fabrications
<input type="checkbox"/>	06 64 00	Plastic (FRP) Paneling
<input type="checkbox"/>	06 64 13	Translucent Resin Panel Fabrications
<input type="checkbox"/>	06 64 19	Simulated Stone Paneling
<input type="checkbox"/>	06 67 13	Louvered Light Diffusers
<input type="checkbox"/>	06 68 13	Plastic Gratings

## DIVISION 07 - THERMAL AND MOISTURE PROTECTION

	<input type="checkbox"/>	07 01 51	Preparation for Re-Roofing
	<input type="checkbox"/>	07 01 52	Patching of Existing Roofing
	<input type="checkbox"/>	07 11 14	Asphalt Mastic Dampproofing
	<input type="checkbox"/>	07 13 28	Pre-Applied Sheet Waterproofing
	<input type="checkbox"/>	07 13 52	Modified Bituminous Sheet Waterproofing
	<input type="checkbox"/>	07 14 13	Hot Fluid-Applied Rubberized Asphalt Waterproofing
07-16-21	<input checked="" type="checkbox"/>	<b>07 14 16</b>	<b>Cold Fluid Applied Waterproofing</b>
	<input type="checkbox"/>	07 16 16	Crystalline Waterproofing
	<input type="checkbox"/>	07 17 00	Bentonite Waterproofing
	<input type="checkbox"/>	07 18 00	Traffic Coatings
07-16-21	<input checked="" type="checkbox"/>	<b>07 19 00</b>	<b>Water Repellents</b>
	<input type="checkbox"/>	07 21 00	Thermal Insulation
	<input type="checkbox"/>	07 21 19	Spray-Applied Foam Insulation
	<input type="checkbox"/>	07 24 00	EIFS
	<input type="checkbox"/>	07 24 23	DEFS for Soffits
	<input type="checkbox"/>	07 25 00	Mechanically Fastened Air and Water Barriers
07-16-21	<input checked="" type="checkbox"/>	<b>07 26 17</b>	<b>Below-Slab Vapor Retarder</b>
	<input type="checkbox"/>	07 26 13	Rubberized Asphalt Vapor Retarders
	<input type="checkbox"/>	07 27 13	Self-Adhering Air and Water Barriers
	<input type="checkbox"/>	07 31 13	Asphalt Shingles
	<input type="checkbox"/>	07 31 27	Simulated Slate Roofing
	<input type="checkbox"/>	07 32 00	Roof Tiles
	<input type="checkbox"/>	07 41 14	Metal Roof Panels
	<input type="checkbox"/>	07 42 13	Formed Metal Wall Panels
	<input type="checkbox"/>	07 42 29	Terra Cotta Wall Panels
	<input type="checkbox"/>	07 42 43	Composite Metal Wall Panels
	<input type="checkbox"/>	07 42 63	Insulated-Core Metal Wall Panels
	<input type="checkbox"/>	07 46 46	Fiber-Cement Siding
	<input type="checkbox"/>	07 50 13	Single-Ply Membrane Roofing
	<input type="checkbox"/>	07 52 16	Modified Bituminous Membrane Roofing
	<input type="checkbox"/>	07 55 56	Fluid-Applied Protected Membrane Roofing
	<input type="checkbox"/>	07 55 63	Vegetated Protected Membrane Roofing
	<input type="checkbox"/>	07 62 00	Sheet Metal Flashing and Trim

- 07 72 00 Roof Accessories
- 07 76 00 Roof Pavers and Pedestal Assemblies
- 07 81 16 Cementitious Fireproofing
- 07 81 23 Intumescent Mastic Fireproofing
- 07 84 13 Penetration Firestopping
- 07 84 46 Fire-Resistive Joint Firestopping
- 07 91 00 Preformed Joint Seals
- 07 92 00 Joint Sealants
- 07 95 00 Expansion Control

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- 08 06 10 Door Schedule
- 08 11 13 Hollow Metal Doors and Frames
- 08 11 14 Interior Hollow Metal Frames
- 08 11 70 Steel Fire Door and Frame Assembly
- 08 12 16 Interior Aluminum Frames
- 08 14 16 Prefinished Flush Wood Doors
- 08 14 33 Stile and Rail Wood Doors
- 08 31 13 Access Doors and Frames
- 08 32 13 Sliding Aluminum-Framed Glass Doors
- 08 33 13 Coiling Counter Doors
- 08 33 23 Overhead Coiling Doors
- 08 33 26 Overhead Coiling Grilles
- 08 33 38 Interior Side Coiling Grilles
- 08 34 00 Special Function Doors
- 08 35 13 Folding Doors
- 08 35 15 Accordion Folding Fire Doors
- 08 36 13 Sectional Overhead Doors
- 08 41 10 Interior Storefront
- 08 41 27 Exterior All-Glass Entrances and Storefronts
- 08 41 28 Interior All-Glass Entrances and Storefronts
- 08 42 13 Exterior Aluminum Entrance Doors
- 08 42 16 Interior Aluminum Entrance Doors
- 08 42 29 Automatic Entrances
- 08 42 33 Revolving Entrance Doors
- 08 42 43 Medical Specialty Sliding Entrances
- 08 44 00 Glazed Aluminum Framing Systems
- 08 44 26 Structural Glass Curtainwall
- 08 45 00 Translucent Insulating Panel Assemblies
- 08 51 13 Aluminum Windows
- 08 56 19 Sliding Pass Windows
- 08 56 56 Bullet-Resistive Windows
- 08 62 00 Unit Skylights
- 08 63 00 Metal-Framed Skylights
- 08 71 00 Door Hardware
- 08 71 21 Interior Automatic Door Operators for Staff Use
- 08 71 22 Automatic Door Operators for the Disabled
- 08 80 00 Glazing
- 08 83 00 Unframed Mirrored Glazing
- 08 88 16 Between Glass Blinds Units
- 08 88 40 Switchable Privacy Glass Units
- 08 91 00 Wall Louvers

## DIVISION 09 – FINISHES

<input type="checkbox"/>	09 05 65	Floor Preparation for Renovation Work
<input type="checkbox"/>	09 06 00	Room Finish Schedule
<input type="checkbox"/>	09 23 00	Gypsum Plastering
<input type="checkbox"/>	09 24 00	Portland Cement Plastering
<input type="checkbox"/>	09 26 00	Veneer Plastering
<input type="checkbox"/>	09 26 13	Gypsum Veneer Plastering
<input type="checkbox"/>	09 27 13	GFRG Fabrications
<input type="checkbox"/>	09 29 00	Gypsum Board Assemblies
<input type="checkbox"/>	09 30 00	Tiling
<input type="checkbox"/>	09 51 13	Acoustical Panel Ceilings
<input type="checkbox"/>	09 51 33	Acoustical Metal Pan Ceilings
<input type="checkbox"/>	09 51 35	Snap-in Metal Pan Ceilings
<input type="checkbox"/>	09 54 23	Linear Metal Ceilings
<input type="checkbox"/>	09 54 36	Suspended Decorative Grids
<input type="checkbox"/>	09 54 51	Linear Wood Wall and Ceiling Systems
<input type="checkbox"/>	09 61 15	Concrete Floor Sealer
<input type="checkbox"/>	09 61 16	Liquid Floor Hardener
<input type="checkbox"/>	09 61 19	Moisture Floor Treatment
<input type="checkbox"/>	09 63 40	Stone Flooring
<input type="checkbox"/>	09 64 00	Wood Flooring
<input type="checkbox"/>	09 65 00	Resilient Flooring
<input type="checkbox"/>	09 65 13	Resilient Base and Accessories
<input type="checkbox"/>	09 65 20	Interlocking Rubber Tile Flooring
<input type="checkbox"/>	09 65 66	Resilient Athletic Flooring
<input type="checkbox"/>	09 66 03	Precast Terrazzo Flooring for Stairs
<input type="checkbox"/>	09 66 13	Thick-Set Terrazzo Flooring
<input type="checkbox"/>	09 66 23	Thin-Set Terrazzo Flooring
<input type="checkbox"/>	09 67 23	Resinous Flooring
<input type="checkbox"/>	09 68 00	Carpeting
<input type="checkbox"/>	09 69 00	Access Flooring
<input type="checkbox"/>	09 72 00	Wall Covering
<input type="checkbox"/>	09 72 13	Tackboard Wall Coverings
<input type="checkbox"/>	09 75 00	Interior Stone Facing
<input type="checkbox"/>	09 77 23	Fabric Wrapped Panels
<input type="checkbox"/>	09 84 33	Acoustical Wall Panels
<input type="checkbox"/>	09 91 00	Painting
<input type="checkbox"/>	09 94 13	Textured Interior Coatings
<input type="checkbox"/>	09 96 00	High-Performance Coatings
<input type="checkbox"/>	09 96 13	Multicolored Interior Coatings
<input type="checkbox"/>	09 96 53	Elastomeric Coatings
<input type="checkbox"/>	09 96 63	Textured Acrylic Coating

## DIVISION 10 - SPECIALTIES

<input type="checkbox"/>	10 11 00	Visual Display Boards
<input type="checkbox"/>	10 11 46	Visual Display Fabrics
<input type="checkbox"/>	10 14 00	Interior Signage
<input type="checkbox"/>	10 14 43	Photoluminescent Exit Path Marking System
<input type="checkbox"/>	10 17 00	Telephone Specialties
<input type="checkbox"/>	10 21 13	Toilet Compartments
<input type="checkbox"/>	10 21 15	Cubicle Specialties
<input type="checkbox"/>	10 22 13	Wire Mesh Partitions
<input type="checkbox"/>	10 22 23	Accordion Folding Partitions

- 10 22 38 Operable Panel Partition
- 10 22 39 Vertically Folding Panel Partitions
- 10 26 13 Wall and Corner Guards
- 10 28 13 Toilet Accessories
- 10 28 19 Shower Doors and Enclosures
- 10 41 16 Emergency Key Cabinets
- 10 44 00 Fire Protection Specialties
- 10 44 50 Automated External Defibrillators (AED)
- 10 51 13 Metal Lockers
- 10 51 16 Wood Lockers
- 10 55 03 USPS-Delivery Postal Specialties
- 10 55 06 Private-Delivery Postal Specialties
- 10 57 13 Wall Mounted Coat Rack and Shelf
- 10 71 13 Exterior Sun Control Devices
- 10 73 10 Aluminum Walkways and Canopies
- 10 75 00 Flagpoles

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- 11 13 00 Loading Dock Equipment
- 11 24 00 Building Maintenance Equipment
- 11 52 13 Projection Screens
- 11 70 00 Medical Equipment
- 11 73 13 Wall-Mounted Fold-Up Writing Surface
- 11 73 16 Wall-Mounted Chart Rack

**DIVISION 12 - FURNISHINGS**

- 12 21 13 Horizontal Louver Blinds
- 12 21 16 Vertical Louver Blinds
- 12 24 13 Roller Window Shades
- 12 25 00 Between Glass Blinds
- 12 35 53 Laboratory Casework
- 12 35 71 Stainless Steel Casework
- 12 36 40 Stone Countertops
- 12 36 61 Simulated Stone Countertops
- 12 48 16 Entrance Floor Grilles
- 12 48 43 Entrance Floor Mats
- 12 63 00 Stadium Seating
- 12 93 13 Bicycle Racks

**DIVISION 13 - SPECIAL CONSTRUCTION**

- 13 28 17 Ballpark Netting and Supports
- 13 34 48 Pre-Fabricated Rooftop Helipad
- 13 49 00 Radiation Protection
- 13 49 23 RF/MRI Modular Shielding Enclosure

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- 14 10 00 Dumbwaiters
- 14 21 00 Electric Traction Elevators
- 14 24 00 Hydraulic Elevators
- 14 31 00 Escalators
- 14 91 00 Chutes

14 92 00 Pneumatic Tube Systems

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- 21 05 13 Common Motor Requirements for Fire Suppression Equipment
- 21 05 17 Sleeves and Sleeve Seals for Fire Suppression Piping
- 21 05 18 Escutcheons for Fire Suppression Piping
- 21 05 23 General-Duty Valves for Water-Based Fire Suppression Piping
- 21 05 48 Vibration and Seismic Controls For Fire-Suppression Piping and Equipment
- 21 11 19 Fire-Department Connections
- 21 13 13 Wet-Pipe Sprinkler Systems
- 21 13 16 Dry- Pipe Sprinkler Systems

### **DIVISION 22 - PLUMBING**

- 22 05 13 Common Motor Requirements for Plumbing Equipment
- 07-16-21  22 05 17 Sleeves and Sleeve Seals for Plumbing Piping
- 07-16-21  22 05 18 Escutcheons for Plumbing Piping
- 22 05 19 Meters and Gages for Plumbing Piping
- 22 05 23 General-Duty Valves for Plumbing Piping
- 22 05 29 Hangers and Supports for Plumbing Piping and Equipment
- 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment
- 22 05 53 Identification for Plumbing Piping and Equipment
- 22 07 19 Plumbing Piping Insulation
- 07-16-21  22 11 16 Domestic Water Piping
- 07-16-21  22 11 19 Domestic Water Piping Specialties
- 07-16-21  22 13 16 Sanitary Waste and Vent Piping
- 07-16-21  22 13 19 Sanitary Waste Piping Specialties
- 07-16-21  22 14 13 Facility Storm Drainage Piping
- 07-16-21  22 14 23 Storm Drainage Piping Specialties
- 07-16-21  22 23 11 Facility Natural-Gas Piping
- 22 34 00 Fuel-Fired, Domestic-Water Heaters
- 22 41 00 Plumbing Fixtures

### **DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

- 23 05 13 Common Motor Requirements for HVAC Equipment
- 23 05 17 Sleeves and Sleeve Seals for HVAC Piping
- 23 05 18 Escutcheons for HVAC Piping
- 23 05 19 Meters and Gages for HVAC Piping
- 23 05 29 Hangers and Supports for HVAC Piping and Equipment
- 23 05 48 Vibration and Seismic Controls for HVAC
- 23 05 53 Identification for HVAC Piping and Equipment
- 23 05 93 Testing, Adjusting, and Balancing for HVAC
- 23 07 13 Duct Insulation
- 23 07 19 HVAC Piping Insulation
- 23 09 23 Direct Digital Controls System
- 23 23 00 Refrigerant Piping
- 23 31 13 Metal Ducts
- 23 33 00 Air Duct Accessories
- 23 33 46 Flexible Ducts
- 23 34 16 Centrifugal HVAC Fans



<input type="checkbox"/>	23 36 00	Air Terminal Units
<input type="checkbox"/>	23 37 13.13	Air Diffusers
<input type="checkbox"/>	23 74 16.13	Packaged, Large-Capacity, Rooftop Air-Conditioning Units
<input type="checkbox"/>	23 74 33	Dedicated Outdoor-Air Units
<input type="checkbox"/>	23 81 26	Split-System Air-Conditioners
<input type="checkbox"/>	23 81 29	Variable-Refrigerant-Flow HVAC Systems

## DIVISION 26 – ELECTRICAL

07-16-21	<input checked="" type="checkbox"/>	26 00 00	Electrical Requirements
07-16-21	<input checked="" type="checkbox"/>	26 05 19	Low-Voltage Electrical Power Conductors and Cable
07-16-21	<input checked="" type="checkbox"/>	26 05 26	Grounding and Bonding for Electrical Systems
	<input type="checkbox"/>	26 05 29	Hangers and Supports for Electrical Systems
07-16-21	<input checked="" type="checkbox"/>	26 05 33	Raceways and Boxes for Electrical Systems
	<input type="checkbox"/>	26 05 39	Underfloor Raceways for Electrical Systems
07-16-21	<input checked="" type="checkbox"/>	26 05 43	Underground Ducts and Raceways for Electrical Systems
07-16-21	<input checked="" type="checkbox"/>	26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
07-16-21	<input checked="" type="checkbox"/>	26 05 53	Identification for Electrical Systems
	<input type="checkbox"/>	26 09 23	Lighting Control Devices
	<input type="checkbox"/>	26 24 16	Panelboards
07-16-21	<input checked="" type="checkbox"/>	26 27 13	Electricity Metering
	<input type="checkbox"/>	26 27 26	Wiring Devices
	<input type="checkbox"/>	26 28 16	Enclosed Switches and Circuit Breakers
	<input type="checkbox"/>	26 51 19	LED Interior Lighting
	<input type="checkbox"/>	26 56 19	LED Exterior Lighting

## DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

<input type="checkbox"/>	28 46 21.11	Addressable Fire-Alarm Systems
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## DIVISION 31 - EARTHWORK

	<input type="checkbox"/>	31 11 00	Cleaning and Grubbing
07-16-21	<input checked="" type="checkbox"/>	31 22 19	Site Grading
07-16-21	<input checked="" type="checkbox"/>	31 23 00	Excavation & Fill
	<input type="checkbox"/>	31 23 11	Earthwork for Building Construction
07-16-21	<input checked="" type="checkbox"/>	31 23 33	Trenching
07-16-21	<input checked="" type="checkbox"/>	31 25 00	Erosion Control
07-16-21	<input checked="" type="checkbox"/>	31 25 73	Temporary Silt Fence
	<input type="checkbox"/>	31 31 16	Termite Control
07-16-21	<input checked="" type="checkbox"/>	31 41 34	Excavation/Trench & Shore
	<input type="checkbox"/>	31 62 18	Mini-Piles
	<input type="checkbox"/>	31 66 13	Aggregate Piers

## DIVISION 32 - EXTERIOR IMPROVEMENTS

<input type="checkbox"/>	32 11 23	Aggregate Base Course
<input type="checkbox"/>	32 13 13	Concrete Paving
<input type="checkbox"/>	32 14 13	Interlocking Precast Concrete Paving
<input type="checkbox"/>	32 14 16	Brick unit Paving
<input type="checkbox"/>	32 14 40	Stone Paving
<input type="checkbox"/>	32 16 13	Concrete Curb & gutters
<input type="checkbox"/>	32 16 14	Concrete Sidewalk
<input type="checkbox"/>	32 17 15	Parking Accessories
<input type="checkbox"/>	32 31 13	Chain Link Fencing

<input type="checkbox"/>	32 31 15	Tubular Steel Fencing
<input type="checkbox"/>	32 31 17	Gate Operators
<input type="checkbox"/>	32 31 21	Cable Guardrail System
<input type="checkbox"/>	32 32 23	Segmental Retaining Walls

**DIVISION 33 - UTILITIES**

<input type="checkbox"/>	33 05 16	Manholes Vaults
<input type="checkbox"/>	33 05 26	Utility Line Marking
<input type="checkbox"/>	33 05 27	Connection to Existing Utilities
<input type="checkbox"/>	33 05 33	Plastic Pipe (Water & San. Swr.)
<input type="checkbox"/>	33 11 13	HDPE Potable Water Pipe
<input type="checkbox"/>	33 12 16	Valves
<input type="checkbox"/>	33 12 19	Hydrants
<input type="checkbox"/>	33 13 00	Disinfection of Waterlines
<input type="checkbox"/>	33 41 00	Storm Drainage

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**LEGEND**

First Column:	Current Issue Date for Section
Second Column:	Indicates Section is Included in Current Issue
Third Column:	Section Number
Fourth Column:	Section Title

**ISSUES**

**Final Construction Documents      Issue Date      July 16, 2021**  
**(BID PACKAGE 01)**

**NOTE FOR REVISED SPECIFICATION SECTIONS**

1. DELETED INFORMATION IS INDICATED BY A STRIKETHROUGH (IE, ~~THIS IS DELETED~~).
2. NEW INFORMATION IS INDICATED BY A DOUBLE UNDERLINE (IE, THIS IS ADDED).
3. ALL REVISED INFORMATION IS FURTHER IDENTIFIED BY A HEAVY VERTICAL LINE TO THE RIGHT OF ALL REVISIONS IN EACH INDIVIDUAL SPECIFICATION SECTION (REFER TO HEAVY BOLD LINE TO THE RIGHT FOR AN EXAMPLE)

## SECTION 00 31 00

### AVAILABLE PROJECT INFORMATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section references other information relevant to the construction of this Project that is available project information.
- B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.
- C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.
- D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

##### 1.2 PROPERTY SURVEY

- A. Surveyor has performed a property survey and is included in the Drawings for the convenience of the Contractor.

##### 1.3 GEOTECHNICAL REPORT

- A. Geotechnical Consultant has made subsurface borings at the Project site, has performed an investigation of the geotechnical conditions, and has prepared a report of the investigation that contains specific requirements of the Contractor. and has been included following this section.
- B. The information was obtained for use in preparing the foundation design, but is indicative only of the soil conditions where the borings are taken.

##### 1.4 EQUIPMENT DOCUMENTS

- A. Kitchen Equipment Planning Consultant has developed equipment documents for the Owner's facility and has prepared construction documents.
- B. [.] [Copies of the documents have been included in the Contract Documents.]

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 00 72 00**

**GENERAL CONDITIONS**

**PART 1 - GENERAL**

**1.1 GENERAL**

- A. The General Conditions of this Contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2007 Edition, hereinafter referred to as the "General Conditions."
- B. The General Conditions of this Contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2007 Edition as amended by the Owner, hereinafter referred to as the "General Conditions."
- C. The General Conditions of this Contract are available from the Owner, hereinafter referred to as the "General Conditions."
- D. The General Conditions of this Contract are that which is referenced in the Owner-Contractor Agreement and hereinafter is referred to as the "General Conditions."
- E. The General Conditions shall apply to each and every Section of the Work as though written in full therein and are made a part of the Contract Documents by reference.
- F. A copy of the Document is included in this Project Manual and shall apply to each and every Section of the Work as though written in full therein.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

END OF SECTION



# AIA<sup>®</sup> Document A201<sup>®</sup> – 2007

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

18-01.08 Cherokee Nation Durbin Feeling Language Center  
Tahlequah, OK

### THE OWNER:

*(Name, legal status and address)*

Cherokee Nation

### THE ARCHITECT:

*(Name, legal status and address)*

James R. Childers Architect, Inc.  
45 South 4th Street,  
Fort Smith, AR 72901

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### ADDITIONS AND DELETIONS:

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**User Notes:**

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## **ARTICLE 1 GENERAL PROVISIONS**

### **§ 1.1 BASIC DEFINITIONS**

#### **§ 1.1.1 THE CONTRACT DOCUMENTS**

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

#### **§ 1.1.2 THE CONTRACT**

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### **§ 1.1.3 THE WORK**

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### **§ 1.1.4 THE PROJECT**

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

#### **§ 1.1.5 THE DRAWINGS**

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

#### **§ 1.1.6 THE SPECIFICATIONS**

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### **§ 1.1.7 INSTRUMENTS OF SERVICE**

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### **§ 1.1.8 INITIAL DECISION MAKER**

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### **§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.



**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### **§ 1.3 CAPITALIZATION**

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### **§ 1.4 INTERPRETATION**

In the interest of brevity the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an,” but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### **§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE**

**§ 1.5.1** The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect’s or Architect’s consultants’ reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect’s consultants.

### **§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM**

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## **ARTICLE 2 OWNER**

### **§ 2.1 GENERAL**

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

**§ 2.1.2** The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein.

### **§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

**§ 2.2.1** Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.2** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

**§ 2.2.3** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.2.4** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

### **§ 2.3 OWNER'S RIGHT TO STOP THE WORK**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

### **§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 GENERAL**

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.3** The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

### **§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

**§ 3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### **§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

**§ 3.3.2** The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

**§ 3.3.3** The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

### **§ 3.4 LABOR AND MATERIALS**

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other



facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

**§ 3.4.2** Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### **§ 3.5 WARRANTY**

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

### **§ 3.6 TAXES**

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### **§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS**

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

**§ 3.7.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

**§ 3.7.3** If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

**§ 3.7.4 Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

**§ 3.7.5** If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume

the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### **§ 3.8 ALLOWANCES**

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

**§ 3.8.2** Unless otherwise provided in the Contract Documents,

- .1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

**§ 3.8.3** Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### **§ 3.9 SUPERINTENDENT**

**§ 3.9.1** The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

**§ 3.9.3** The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### **§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES**

**§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

**§ 3.10.2** The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### **§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE**

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### **§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be

required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### **§ 3.13 USE OF SITE**

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### **§ 3.14 CUTTING AND PATCHING**

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### **§ 3.15 CLEANING UP**

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

### **§ 3.16 ACCESS TO WORK**

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

### **§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS**

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.



### **§ 3.18 INDEMNIFICATION**

**§ 3.18.1** To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

## **ARTICLE 4 ARCHITECT**

### **§ 4.1 GENERAL**

**§ 4.1.1** The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**§ 4.1.2** Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

**§ 4.1.3** If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

### **§ 4.2 ADMINISTRATION OF THE CONTRACT**

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

#### **§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION**

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

**§ 4.2.5** Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

**§ 4.2.6** The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

**§ 4.2.7** The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

**§ 4.2.8** The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

**§ 4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

**§ 4.2.10** If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

**§ 4.2.11** The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

**§ 4.2.12** Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

**§ 4.2.13** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

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**§ 4.2.14** The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## **ARTICLE 5 SUBCONTRACTORS**

### **§ 5.1 DEFINITIONS**

**§ 5.1.1** A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

**§ 5.1.2** A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### **§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**

**§ 5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

**§ 5.2.2** The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

**§ 5.2.3** If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

**§ 5.2.4** The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

### **§ 5.3 SUBCONTRACTUAL RELATIONS**

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may

be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

#### **§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

**§ 5.4.1** Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

### **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

#### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

#### **§ 6.2 MUTUAL RESPONSIBILITY**

**§ 6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that



the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 OWNER'S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## **ARTICLE 7 CHANGES IN THE WORK**

### **§ 7.1 GENERAL**

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

### **§ 7.2 CHANGE ORDERS**

**§ 7.2.1** A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### **§ 7.3 CONSTRUCTION CHANGE DIRECTIVES**

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

**§ 7.3.4** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

**§ 7.3.5** Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

**§ 7.3.6** A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

**§ 7.3.8** The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

**§ 7.3.9** Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

**§ 7.3.10** When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### **§ 7.4 MINOR CHANGES IN THE WORK**

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

## **ARTICLE 8 TIME**

### **§ 8.1 DEFINITIONS**

**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Agreement.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

**§ 8.1.4** The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

### **§ 8.2 PROGRESS AND COMPLETION**

**§ 8.2.1** Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

**§ 8.2.2** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### **§ 8.3 DELAYS AND EXTENSIONS OF TIME**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor’s control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

**§ 8.3.2** Claims relating to time shall be made in accordance with applicable provisions of Article 15.

**§ 8.3.3** This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 CONTRACT SUM**

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### **§ 9.2 SCHEDULE OF VALUES**

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment.

### **§ 9.3 APPLICATIONS FOR PAYMENT**

**§ 9.3.1** At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor’s right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### § 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;



- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

### § 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

### § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended

appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

## **§ 9.8 SUBSTANTIAL COMPLETION**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

## **§ 9.9 PARTIAL OCCUPANCY OR USE**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

**§ 9.9.3** Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

## **§ 9.10 FINAL COMPLETION AND FINAL PAYMENT**

**§ 9.10.1** Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect

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will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**§ 9.10.4** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## **ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

### **§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS**

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

### **§ 10.2 SAFETY OF PERSONS AND PROPERTY**

**§ 10.2.1** The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.



**§ 10.2.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

**§ 10.2.3** The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

**§ 10.2.4** When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

#### **§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

#### **§ 10.3 HAZARDOUS MATERIALS**

**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.



**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

#### **§ 10.4 EMERGENCIES**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

### **ARTICLE 11 INSURANCE AND BONDS**

#### **§ 11.1 CONTRACTOR'S LIABILITY INSURANCE**

**§ 11.1.1** The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

**§ 11.1.2** The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction

of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

**§ 11.1.3** Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

**§ 11.1.4** The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

## **§ 11.2 OWNER'S LIABILITY INSURANCE**

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

## **§ 11.3 PROPERTY INSURANCE**

**§ 11.3.1** Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

**§ 11.3.1.1** Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

**§ 11.3.1.2** If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

**§ 11.3.1.3** If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

**§ 11.3.1.4** This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

**§ 11.3.1.5** Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

### **§ 11.3.2 BOILER AND MACHINERY INSURANCE**

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

### **§ 11.3.3 LOSS OF USE INSURANCE**

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

**§ 11.3.4** If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

**§ 11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

**§ 11.3.6** Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

### **§ 11.3.7 WAIVERS OF SUBROGATION**

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

**§ 11.3.8** A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

**§ 11.3.9** If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the



Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

**§ 11.3.10** The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

#### **§ 11.4 PERFORMANCE BOND AND PAYMENT BOND**

**§ 11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

**§ 11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

### **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

#### **§ 12.1 UNCOVERING OF WORK**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

#### **§ 12.2 CORRECTION OF WORK**

##### **§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

##### **§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### **§ 12.3 ACCEPTANCE OF NONCONFORMING WORK**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 GOVERNING LAW**

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### **§ 13.2 SUCCESSORS AND ASSIGNS**

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### **§ 13.3 WRITTEN NOTICE**

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### **§ 13.4 RIGHTS AND REMEDIES**

**§ 13.4.1** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

**§ 13.4.2** No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

## § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

## § 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

## § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

**§ 14.1.2** The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

**§ 14.1.4** If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

#### **§ 14.2 TERMINATION BY THE OWNER FOR CAUSE**

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

**§ 14.2.2** When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

#### **§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.



**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

#### **§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

### **ARTICLE 15 CLAIMS AND DISPUTES**

#### **§ 15.1 CLAIMS**

##### **§ 15.1.1 DEFINITION**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

##### **§ 15.1.2 NOTICE OF CLAIMS**

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

##### **§ 15.1.3 CONTINUING CONTRACT PERFORMANCE**

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

##### **§ 15.1.4 CLAIMS FOR ADDITIONAL COST**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

##### **§ 15.1.5 CLAIMS FOR ADDITIONAL TIME**

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.



### § 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

### § 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

### § 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

### § 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an

additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.



Init.

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# **Additions and Deletions Report for** **AIA® Document A201® – 2007**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 17:11:53 ET on 11/20/2020.

## **PAGE 1**

18-01.08 Cherokee Nation Durbin Feeling Language Center  
Tahlequah, OK

...

Cherokee Nation

...

James R. Childers Architect, Inc.  
45 South 4th Street,  
Fort Smith, AR 72901

## **Certification of Document's Authenticity**

**AIA® Document D401™ – 2003**

I, J. Breck Childers, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 17:11:53 ET on 11/20/2020 under Order No. 7732167032 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2007, General Conditions of the Contract for Construction, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

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*(Signed)*

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*(Title)*

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*(Dated)*

## SECTION 01 25 00

### SUBSTITUTION PROCEDURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

##### 1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

##### 1.3 SUBMITTALS

- A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use scanned PDF electronic file of form provided at end of this section or annotated PDF electronic file of electronic form received from Architect matching form provided at end of this section.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. Certificates and qualification data, where applicable or requested.
    - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
    - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided



within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

- k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

#### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

#### **1.5 PROCEDURES**

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

### **PART 2 - PRODUCTS**

#### **2.1 SUBSTITUTIONS**

- A. Prior to starting Substitution Process, review proposed recommendations with Architect.
- B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
- C. Contractor Representations: By making substitution request, Contractor:
  - 1. Recognizes burden of proof of equality for requested substitution rests with Contractor.
  - 2. Represents and warrants that Contractor has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
  - 3. Represents and warrants that Contractor will provide same warranties for requested substitution that Contractor would for specified Work.
  - 4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
  - 5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
  - 6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Contractor shall replace accepted substitution with specified Work at no additional cost to Owner.
- D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Requested substitution provides sustainable design characteristics that specified product provided.
  - c. Substitution request is fully documented and properly submitted.
  - d. Requested substitution will not adversely affect Contractor's construction schedule.
  - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - f. Requested substitution is compatible with other portions of the Work.
  - g. Requested substitution has been coordinated with other portions of the Work.
  - h. Requested substitution provides specified warranty.

E. Substitutions for Convenience:

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Requested substitution provides sustainable design characteristics that specified product provided.
  - e. Substitution request is fully documented and properly submitted.
  - f. Requested substitution will not adversely affect Contractor's construction schedule.
  - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - h. Requested substitution is compatible with other portions of the Work.
  - i. Requested substitution has been coordinated with other portions of the Work.
  - j. Requested substitution provides specified warranty.

**PART 3 - EXECUTION (Not Used)**

END OF SECTION

**SECTION 01 25 00**

**SUBSTITUTION REQUEST FORM**

**Project Name** \_\_\_\_\_

**Specified Item**

Section	Page	Paragraph	Description
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The undersigned General Contractor requests consideration of the following:

**Proposed Substitution**

(Include all product data as indicated in Specification Section 01 2500 and any supplemental information as requested by the Architect.)

The undersigned General Contractor warrants to the Architect and Owner that the following paragraphs, unless modified on attachments, are correct.

1. The Proposed Substitution does not affect dimensions shown on Drawings.
2. The cost reduction/increase indicated in item 5 below includes costs for changes to the building design, including engineering, design, detailing and construction costs caused by the requested Substitution. Any additional costs resulting from this substitution will be reimbursed from the cost savings in item 5 or, in it's absence, funded as a project cost.
3. The Proposed Substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the Proposed Substitution.

The General Contractor further warrants to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The General Contractor further warrants that the intent of specification section 01 25 00, paragraph 2.1.C has been met.

5. Total Cost Savings/Increase to the Owner: \$ \_\_\_\_\_
6. Compensation to the Architect / Consultant for related Additional Service fee: \$ \_\_\_\_\_

**Manufacturer's Certification of Equal Quality**

I \_\_\_\_\_ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

_____	_____	_____
Manufacturer's Representative	Date	Company

**Acceptances**

1.

_____	_____	_____
General Contractor Acceptance	Date	Company

2.

_____	_____	_____
Owner Acceptance	Date	Company

3.

_____	_____	_____
Architect Acceptance	Date	Company

4.

_____	_____	_____
Consultant Acceptance	Date	Company

**Recommend Acceptance:**  Yes  No



## SECTION 01 26 00

### CONTRACT MODIFICATION PROCEDURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

##### 1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's Form 710 "Architect's Supplemental Instructions"; copy attached at the end of this Section.

##### 1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's Form 709 "Proposed Change"; copy attached at the end of this Section. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
  - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - c. Include costs of labor and supervision directly attributable to the change.
  - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - e. Include updated Submittal Schedule showing effect of the change.

- B. Contractor-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect using Contractor's Standard Form.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times,



and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

#### **1.4 ADMINISTRATIVE CHANGE ORDERS**

- A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.
- C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

#### **1.5 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor on Architects Form 701 "Change Order"; copy attached at the end of this Section.

#### **1.6 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Architects Form 714 "Construction Change Directive"; copy attached at the end of this Section. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

### **PART 2 - PRODUCTS (Not Used)**

### **PART 3 - EXECUTION (Not Used)**

END OF SECTION

## SECTION 01 29 00

### PAYMENT PROCEDURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

##### 1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Accepted Alternates.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
  - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
  - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders.
    - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

- 1) Labor.
  - 2) Materials.
  - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
  4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
  6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
  9. Change Orders: Provide a separate line item in the schedule of values for each change order.
  10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
  11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
  12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
  13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

### **1.3 ARCHITECTS COST DATA**

- A. In addition to the Schedule of Values, submit itemized cost data reporting on Architect's Form HKS-757 "Project Cost Summary"; copy attached at the end of this Section. Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

### **1.4 APPLICATIONS FOR PAYMENT**

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
  2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from General Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
    - a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Schedule of unit prices.
  6. Submittal schedule (preliminary if not final).
  7. List of Contractor's staff assignments.
  8. List of Contractor's principal consultants.
  9. Copies of building permits.
  10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  11. Initial progress report.
  12. Report of preconstruction conference.
  13. Certificates of insurance and insurance policies.
  14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. When applicable, this application shall reflect Certificate(s) of **Partial** Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. If applicable, final liquidated damages settlement statement.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION



## SECTION 01 31 00

### PROJECT MANAGEMENT AND COORDINATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General coordination procedures.
  2. Coordination drawings.
  3. Requests for Information (RFIs).
  4. Project Web site.
  5. Project meetings.

##### 1.2 DEFINITIONS

- A. Project communications documents shall be defined as the following:
1. Letters.
  2. Memoranda.
  3. E-Mail Communications/Internet Communications/Project Management Software Communications.
  4. RFI (Request for Information - Contractor).
  5. RFI-A (Request for Information - Architect).

##### 1.3 FORMAT

- A. Letters and Memoranda: Submit in formats acceptable to the Architect.
- B. E-Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
- C. RFI (Request for Information - Contractor): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use Architect's Form 750, "Request for Information"; copy attached at the end of this Section.
- D. RFI-A (Request for Information - Architect), will be submitted by Architect to Contractor on Architects standard form.

##### 1.4 PROJECT COMMUNICATIONS DOCUMENTS

- A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.
- B. E-Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.

- C. RFI (Request for Information - Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:
1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
  2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
    - a. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
  3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
  4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
  5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
  6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
  7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
    - a. Project name.
    - b. Name and address of Contractor.
    - c. Name and address of Architect.
    - d. RFI number including RFIs that were returned without action or withdrawn.
    - e. RFI description.
    - f. Date the RFI was submitted.
    - g. Date Architect's response was received.
  8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
    - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

- D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.
1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
  2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.
- E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Contractor shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

## **1.6 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

## 1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - e. Indicate required installation sequences.
    - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
  3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
    - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
  4. If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

- b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
- c. Distribution: Digital data files shall only be distributed via the Architect's Thru site with acceptance of Architect's data licensing agreement.

## **1.8 PROJECT WEB SITE**

- A. Use Architect's Project Web site implementing Architect's electronic project management software system for purposes of managing project communication and documentation until Final Completion.
- B. Contractor, subcontractors, and other parties granted access to Project Web site shall execute a data licensing agreement in the form of AIA Document C106.

## **1.9 PROJECT MEETINGS**

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
  - 4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
  - 1. Conduct the conference to review responsibilities and personnel assignments.
  - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
  - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
  - a. Preparation of record documents.
  - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
  - c. Submittal of written warranties.
  - d. If applicable, requirements for completing sustainable design documentation.
  - e. Requirements for preparing operations and maintenance data.
  - f. Requirements for delivery of material samples, attic stock, and spare parts.
  - g. Requirements for demonstration and training.
  - h. Preparation of Contractor's punch list.
  - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - j. Submittal procedures.
  - k. If applicable, coordination of separate contracts.
  - l. If applicable, Owner's partial occupancy requirements.
  - m. Installation of Owner's furniture, fixtures, and equipment.
  - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following or as needed:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) If applicable, resolution of BIM component conflicts.
    - 4) Status of submittals.
    - 5) If applicable, status of sustainable design documentation.
    - 6) Deliveries.
    - 7) Off-site fabrication.
    - 8) Access.



- 9) Site utilization.
  - 10) Temporary facilities and controls.
  - 11) Work hours.
  - 12) Hazards and risks.
  - 13) Progress cleaning.
  - 14) Quality and work standards.
  - 15) Status of correction of deficient items.
  - 16) Field observations.
  - 17) Status of RFIs.
  - 18) Status of proposal requests.
  - 19) Pending changes.
  - 20) Status of Change Orders.
  - 21) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
- 1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) If applicable, resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site utilization.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) Change Orders.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE**

- A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.
  - 1. Basis of Design (Product Standard):

a. Newforma, Inc.; Newforma Project Cloud, web-based software.

- 1) Website: [www.NewformaProjectCloud.com](http://www.NewformaProjectCloud.com)
- 2) E-mail: [projectcloud@newforma.com](mailto:projectcloud@newforma.com)
- 3) Phone: (800) 303-4650

B. Performance Requirements:

1. Project License:

- a. Cloud based (no hardware required).
- b. Unlimited user accounts.
- c. Functionality to support subcontractors, contractors, architects and consultants.
- d. Provide access to data for all project team members at no cost to the individual users.

2. Training and Support:

- a. Dedicated project training.
- b. Phone support.

3. Archive:

- a. Export all data to an offline archive at the completion of the project.
- b. Provide archive to architect, contractor and owner.
- c. Archive shall include all attachments, meta data, review comments and time stamp history.

4. Submittals and RFIs:

- a. Customizable logs and reporting accessible by all users.
- b. Logs shall automatically update as submittals and RFIs are processed.
- c. Automated routing of submittals and RFIs to design team based on trade.
- d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
- e. Automated weekly email to design team users of overdue items.
- f. Automatic sequential numbering per spec section for submittals.
- g. Two sets of due dates - one overall due date and a consultant due date.
- h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

5. Submittal Register:

- a. Software vendor shall take specifications and build the required list of submittals and import into the software.

6. Drawing Management:

- a. Provide current set of drawings and specifications through a centralized index.
- b. Automated association of PDFs to the centralized index.
- c. Manage drawing revisions with customizable review states.
- d. Drawings shall be accessible offline via mobile devices.

7. File Sharing:

- a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
- b. Access permissions (view/edit) at a folder level.

8. Punch List and other Field Task Management:

- a. Unlimited customizable field task types including punch list.
- b. Locate and assign tasks from a mobile device.
- c. No additional fees to individual users to access mobile apps.
- d. Data shall be accessible offline on mobile devices.

**PART 3 - EXECUTION (Not Used)**

END OF SECTION

## SECTION 01 32 00

### CONSTRUCTION PROGRESS DOCUMENTATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.
- B. Related Section:
  - 1. Provide Construction Photographs in accordance with Division 01 Section "Photographic Documentation".

##### 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Major Area: A story of construction, a separate building, or a similar significant construction element.
- C. Milestone: A key or critical point in time for reference or measurement.
- D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- G. Event: The starting or ending point of an activity.
- H. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- I. Fagnets: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

### **1.3 SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
  - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

### **1.4 COORDINATION**

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## **PART 2 - PRODUCTS**

### **2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
  4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  3. Products Ordered in Advance: Include a separate activity for each product.
  4. Owner-Furnished Products: Include a separate activity for each product.
  5. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
  7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:



- a. Structural completion.
  - b. Temporary enclosure and space conditioning.
  - c. Permanent space enclosure.
  - d. Completion of mechanical installation.
  - e. Completion of electrical installation.
  - f. Substantial Completion.
8. Other Constraints include but are not limited to the following:
- a. Roads.
  - b. Parking.
  - c. Landscape.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, punch list activities, Substantial Completion, and final completion.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## **2.2 STARTUP CONSTRUCTION SCHEDULE**

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.

## **2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)**

- A. Bar Chart/Gantt Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## **2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)**

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Purchase of materials.
    - c. Delivery.
    - d. Fabrication.
    - e. Installation.
    - f. Punch list and final completion.
  2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment, fragnet, to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.

9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
  2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
  3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
  4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

## 2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. High and low temperatures and general weather conditions, including presence of rain or snow.
  5. Accidents.
  6. Meetings and significant decisions.
  7. Unusual events (see special reports).
  8. Stoppages, delays, shortages, and losses.
  9. Meter readings and similar recordings.
  10. Emergency procedures.
  11. Orders and requests of authorities having jurisdiction.
  12. Change Orders received and implemented.
  13. Construction Change Directives received and implemented.
  14. Services connected and disconnected.
  15. Equipment or system tests and startups.
  16. Partial completions and occupancies.
  17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## **2.6 SPECIAL REPORTS**

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## **PART 3 - EXECUTION**

### **3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
  - 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
  - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect-Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

### **3.2 CONSTRUCTION PHOTOGRAPHS**

- A. Photographer: Engage a qualified professional commercial photographer to take electronic construction photographs.
- B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.
- C. Acceptable Electronic File Format: .jpg, .tif, .tiff, .tga, .jpe, or .png.

- D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- E. Image File Naming Convention (separate by an underscore \_):
  - 1. Project Job Number / Year-Month-Day / Image Number . file extension
- F. Print Format: 8 in (200 mm) by 10 in (250 mm) smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 in (25 mm) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
- G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
  - 1. Name of Project.
  - 2. Name and address of photographer.
  - 3. Name of Architect.
  - 4. Name of Contractor.
  - 5. Date photograph was taken.
  - 6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and CD ROMs with digital files as required under "Submittals" Article.
- I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and CD ROMs with digital files as required under "Submittals" Article.
  - 1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.
- J. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

END OF SECTION

## SECTION 01 33 00

### SUBMITTAL PROCEDURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

##### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.
- B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.
- C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.
- D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.
- E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

##### 1.3 SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.



- e. Description of the Work covered.
- f. Scheduled date for Architect's final release or approval.

#### 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: If approved by the by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings. .
  - 1. Distribution: Digital data files shall only be distributed via the HKS Thru site with acceptance of HKS data licensing agreement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.
- D. Paper Submittals: Architect reserves the right to require paper submittals.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number, including revision identifier.
    - a. File Naming Convention (separate by dashes - or underscores \_ ):
      - 1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf
  - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  - 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.

- c. Name and address of Architect.
  - d. Name of Contractor.
  - e. Name of firm or entity that prepared submittal.
  - f. Names of subcontractor, manufacturer, and supplier.
  - g. Category and type of submittal.
  - h. Submittal purpose and description.
  - i. Specification Section number and title.
  - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Related physical samples submitted directly.
  - n. Indication of full or partial submittal.
  - o. Transmittal number, numbered consecutively.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. HKS Job Number and Add Service Number (e.g. 14424.000)
  - b. Project name.
  - c. Number and title of appropriate Specification Section.
  - d. Manufacturer name.
  - e. Product name.
  - f. Submittal revision number.
6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On page, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
- 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in file name and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.
- I. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

## **PART 2 - PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

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Language Center  
Childers Architect

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SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
    - b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.
  2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's installation instructions.
    - c. Mill reports.
    - d. Standard product operating and maintenance manuals.
    - e. Certification that products are appropriate for installation indicated.
    - f. Manufacturer's catalog cuts.
    - g. Manufacturer's product specifications.
    - h. Standard color charts.
    - i. Statement of compliance with specified referenced standards.
    - j. Testing by recognized testing agency.
    - k. Application of testing agency labels and seals.
    - l. Notation of coordination requirements.
    - m. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
  - a. Identification of products.
  - b. Dimensions.
  - c. Fabrication and installation drawings.
  - d. Roughing-in and setting diagrams.
  - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Design calculations.
  - i. Schedules.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
  - m. Relationship and attachment to adjoining construction clearly indicated.
  - n. Seal and signature of professional engineer.
  
2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
4. Submit Shop Drawings in the following format:
  - a. PDF electronic file.
  
5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.
  - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
  - b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.
  
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## **2.2 DELEGATED-ENGINEERING SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.



1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.
  1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

### **PART 3 - EXECUTION**

#### **3.1 CONTRACTOR'S REVIEW**

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### **3.2 ARCHITECT'S ACTION**

- A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as follows:
  1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
  2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
  3. Submittals Not Required: Where a submittal is primarily for other Contractor activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents".
- B. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the

time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.

- C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.
- G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

## SECTION 01 40 00

### QUALITY REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

##### 1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.
  - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
  - ~~3. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.~~
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

- E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- A. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

### **1.3 CONFLICTING REQUIREMENTS**

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### **1.4 CONTRACTOR'S QUALITY-CONTROL PLAN**

- A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.

- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
  - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
  - 1. Name, address, and telephone number of technical representative making report.
  - 2. Statement on condition of substrates and their acceptability for installation of product.
  - 3. Statement that products at Project site comply with requirements.
  - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Statement whether conditions, products, and installation exceed manufacturer's statements.
  8. Other required items indicated in individual Specification Sections.
- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. **Permits, Licenses, and Certificates:** For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 **QUALITY ASSURANCE**

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.



1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. **Mock-ups:** Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
    - a. Show typical components, attachments to building structure, and requirements of installation.
  2. Clean exposed faces of mock-up.
  3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
  4. Demonstrate the proposed range of aesthetic effects and workmanship.
  5. Protect accepted mock-up from the elements with weather-resistant membrane.
  6. Obtain Architect's acceptance of mock-ups before starting fabrication.
  7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.

8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

L. Integrated Exterior Mockups: See Division 01 Section "Visual Mock-Up Requirements".

~~M. Room Mockups: See Division 01 Section "Visual Mock-Up Requirements".~~

~~N. Laboratory Mockups: See Division 01 Section "Testing Mock-Up for Building Enclosure System".~~

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 5. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule.
  - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
    - a. Prepare in tabular form and include the following:
      - 1) Specification Section number and title.
      - 2) Entity responsible for performing tests and inspections.
      - 3) Description of test and inspection.
      - 4) Identification of applicable standards.
      - 5) Identification of test and inspection methods.
      - 6) Number of tests and inspections required.
      - 7) Time schedule or time span for tests and inspections.
      - 8) Requirements for obtaining samples.
      - 9) Unique characteristics of each quality-control service.

## **1.8 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
  3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  5. Retesting and reinspecting corrected work.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### **3.2 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

## SECTION 01 43\_39

### VISUAL MOCK-UP REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section specifies full size mock-up requirements of building components to verify material selections, demonstrate aesthetic effects and review construction and workmanship.
- B. Approved mock-up shall establish the standard by which the Work will be judged.
- C. Acceptance of mock-up does not constitute approval of deviations from the Contract Documents in mock-up, unless such deviations are specifically approved by Architect in writing.
- D. Retain mock-ups during construction and maintain in an undisturbed condition. Do not demolish alter or remove mock-up until approved by Architect.
- E. Mock-up shall be used to demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria.
- F. Submit shop drawings prior to fabrication of visual mock-up, showing plan, elevations and details of mock-up.

##### 1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for mock-up products and systems and do not necessarily indicate or specify total Work required or structural support required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete mock-up installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including mock-up support structure.
  - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. As specified in individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use the same workers to do work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- B. Provide mock-up complete with corners, splice joints, control joints, sealants, and complete finish with details identical to those proposed for use in the building and as indicated on the drawings.
- C. Do not use special measures or techniques, which are not representative of those to be used in the building. Finish the various components to show the maximum variation that will exist in the actual building construction between adjacent components.
- D. Notify Architect when construction of mock-up begins and when major components are to be installed.
- E. Complete the mock-up and obtain Architect's approval of each component of the mock-up prior to fabrication or purchase of products for the Project.

### 3.2 BUILDING EXTERIOR WALL

- A. Fabricate and erect a visual mock-up of the typical exterior wall condition with one outside corner returning to the window line.
  - 1. ~~Mock-up size: As indicated on drawing elevations.~~
  - 2. ~~Mock-up size: Two stories high, one bay wide.~~
  - 3. ~~Mock-up size: Vision window and spandrel condition.~~
  - 4.1. **Mock-up size:** 100 square feet.
- B. Provide structural steel frame work for support of visual mock up. Frame work shall be designed by a registered professional or structural engineer licensed in the State where the Project is located.
- C. Coordinate with Architect and Owner for location of mock-up on project site. When directed, demolish mock-ups and remove from Project site.
- D. Construct mock-up in such a manner that each type of exterior finishes will be demonstrated in a layered fashion from one side to the other. The purpose in the layers is to facilitate the review of the multiple activities that are required to accomplish the final finish.
- E. Construct mock-up in phases so that proposed construction methodologies can be observed. Mock-up shall be completely constructed, just as if it were the finished exterior wall. Wall insulation and interior wall finishes are not required.
- F. In addition to specifics in the respective Specification Sections, the mock-up will be reviewed by the Owner and the Architect for the following evaluation purposes:
  - 1. Aesthetic: To review and verify selections made under submittals, as well as to show compliance with visual criteria. Acceptance criteria is for general and specific aesthetic qualities of construction, and includes, but is not limited to, the following as applicable:
    - a. Color, texture, and blending of masonry units.
    - b. Consistency of masonry mortar color.



- c. Tooling of masonry mortar joints.
  - d. Color, texture and finishing of exterior insulation and finish system (EIFS).
  - e. Tooling of sealants.
  - f. Color consistency of aluminum window framing.
  - g. Color and clarity of glass.
  - h. Flatness and alignment of aluminum composite material panels.
2. Installation Execution: To review and verify quality of workmanship, and compliance with Drawings, Specification and submittals. Acceptance criteria is for general and specific erection, installation and application qualities of construction, and includes, but is not limited to, the following as applicable:
- a. Masonry bonding and mortar character.
  - b. Brick cavity cleanliness.
  - c. Brick cavity drainage function.
  - d. Masonry anchor and ties integrity.
  - e. Masonry flashing fabrication and embedment within the masonry.
  - f. Assembly of various components of the exterior insulation and finish system (EIFS), including color, texture and finishing.
  - g. Cold-formed metal framing fabrication and assemblage.
  - h. Glazed aluminum wall system fabrication, anchorage/attachment, and installation quality.
  - i. Glazing integrity.
  - j. Sealant profile consistency and bonding integrity.
  - k. Attachment of aluminum composite material panels.
  - l. Dimensional tolerances.

### 3.3 TYPICAL ROOM MOCK-UP

- A. Arrange for the construction of a typical room mock-up located in the building, per mutual agreement between Owner and Contractor.
  - 1. **Typical Restrooms:** At the first installation of a typical office restroom, complete finishes, fixtures and accessories in one restroom module as a visual mock-up.
  - 2. **Typical Patient Room:** At the first installation of a typical hospital patient room, complete finishes, fixtures and accessories in one patient room module as a visual mock-up.
  - 3. **Typical Hotel Room:** At the first installation of a typical hotel room, complete finishes, fixtures and accessories in one hotel room module as a visual mock-up.
- B. The materials trades Subcontractors shall do all work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- C. Typical Room mock-up shall be complete with finishes, fixtures and details identical to those proposed for use in the Project. Do not use special measures or techniques, which are not representative of those to be used in the finish work. Finish the various components to show the quality of material and construction that will exist in the actual construction.
- D. Typical room mock-up shall be of adequate size to contain all samples and demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria. Submit shop drawings to show layout of room prior to construction. Mock-up room shall be constructed as soon as sufficient structure is available to allow installation.

- E. Materials or workmanship not approved shall be removed and replaced with acceptable products or workmanship. Fabrication, purchase or installation of materials for the building shall not begin until approved in the mock-up room. Owner's approval of samples will be required on all visual items prior to any contractor's buy-out.
  
- F. Materials installed in the room mock-up shall include an example of all furnished assemblies, hardware, equipment or accessories required for the Project and shall include, but may not be necessarily limited to the following as applicable:
  - 1. Lavatory countertop, complete with sealant, sink, accessories, trim, etc.
  - 2. Flush Wood veneer door
  - 3. Hollow Metal Door Frame
  - 4. Door Hardware
  - 5. Ceramic floor and wall material
  - 6. Vinyl Wall Covering(s)
  - 7. Toilet Compartment complete with partition, side wall, pilaster, door and hardware.
  - 8. Toilet Room Accessories
  - 9. Water closet and trim
  - 10. Urinal and trim
  - 11. Lighting
  - 12. Electrical Devices and Accessories
  - 13. Access Doors or Panels

END OF SECTION

## SECTION 01 45 29 - TESTING LABORATORY SERVICES

### PART 1: GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Requirements for the Contractor to engage a qualified, independent testing laboratory to conduct specific tests, where the Contractor is required to do so in this contract. List of tests and schedule below is to be considered a minimum. Additional testing may be required to insure quality. Contractor shall obtain and review reports or recommendations prepared by professional consultants such as Geotechnical Engineers, Structural Engineers or other consultants for additional or more stringent requirements for testing. This section is only intended to be applied to sitework construction. Refer to Architectural/Structural documents for testing related to building, building foundation or other architectural items.

#### 1.2 SUBMITTALS

- A. Test Reports: The Contractor shall provide 4 copies of test reports to the Owners Representative. Reports shall include testing facility name, address, telephone number, and names of full-time responsible officers.

#### 1.3 QUALITY ASSURANCE

- A. Approval of Laboratory: The qualified, independent testing laboratory, which will be conducting the specific tests required in this contract, must have authority or be licensed to operate in the State in which the project is located. The testing laboratory shall be approved by the Owners Representative prior to the Contractor beginning work.
- B. Responsibilities of Laboratory:
  - 1. Test samples of mixes submitted by the Contractor.
  - 2. Provide qualified personnel at project site. Cooperate with the Owners Representative and Contractor in performance of services.
  - 3. Perform specified sampling and testing of products and materials in accordance with specified standards.
  - 4. Ascertain compliance of materials and mixes with requirements of specifications.
  - 5. Promptly notify the Owners Representative and Contractor of observed irregularities or non-conformance of work, products, or materials.
  - 6. Attend preconstruction meetings and progress meetings, if requested.
- C. Limitations on Laboratory:
  - 1. Laboratory may not release, revoke, alter, or enlarge on requirements of specifications or technical recommendations.
  - 2. Laboratory may not approve or accept partial portions of the work.
  - 3. Laboratory may not assume duties of the Contractor unless approved in writing by the Owners Representative.

#### 1.4 SEQUENCING AND SCHEDULING

- A. Establishing Testing Schedule:
  - 1. By advance discussion with the testing laboratory, determine the time required for the laboratory to perform its test and to issue its findings.
  - 2. Provide required time within the construction schedule.
- B. Revising Testing Schedule: When construction schedule changes are necessary during construction, coordinate such changes with the testing laboratory as required.

**PART 2: PRODUCTS**

- A. Reports: Shall include:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Name of inspector.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and specification sections.
  - 6. Location in the Project.
  - 7. Type of inspection or test.
  - 8. Date of test.
  - 9. Results of tests.
  - 10. State conformance or non-conformance with Contract Documents.
  
- B. Interpretation: When requested by the Owners Representative, provide interpretation of test results.

**PART 3: EXECUTION**

**3.1 FIELD QUALITY CONTROL**

- A. Contractor Requirements: See individual specifications "Field Quality Control" paragraph for specific testing requirements. When applicable, the Contractor shall:
  - 1. Deliver to agency or laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work.
  - 3. Provide incidental labor and facilities:
    - a. To obtain, handle, and label or identify samples at the site or at source of products and materials to be tested.
    - b. To facilitate tests.
    - c. To provide storage and curing of test samples.
  - 4. Ensure samples are taken by qualified testing personnel.
  - 5. Coordinate the laboratory test frequency and timing with the Owners Representative.
  - 6. Ensure tests are completed according to the testing schedule.
  - 7. Furnish test reports within 7 working days after tests have been completed.

**B. Building and Bridge Field Testing:**

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Structural Fill	foundation	AASHTO T 238	1/1500 sf or 4 Tests per 8- inch Lift min.	field density & moisture content
Structural Fill	source	AASHTO T 248	1/soil type	field sample/ splitting
Structural Fill	source	AASHTO T 90 type	1/soil	plastic index
Embankment	foundation	AASHTO T 238	1/2500 sf per lift	field density & moisture content

Embankment	source	AASHTO T 248	1/soil type	field sample/ splitting
Embankment	source	AASHTO T 90	1/soil type	plastic index
Aggregate	under floor slab	AASHTO T 27	1/source	plastic index
Aggregate	under floor slab	AASHTO T 238	1/1500 sf per lift	field density and moisture content
Concrete	structural	ASTM C 31	1 set/50 cubic yards or per day	cylinder; 1 set= 4 cylinders
Concrete	structural	ASTM C 143	1/truck	slump
Concrete	structural	ASTM C 2311/truck		air content fresh concrete

C. Roads/Streets Field Testing:

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Subgrade	along centerline	AASHTO T 145	1/5000 sf	AASHTO soil classification
Subgrade	left shoulder centerline right shoulder	AASHTO T 238	1 test/5000 sf or 8-inch lift	in-place density and moisture content
Subbase/left shoulder Base centerline		AASHTO T 238	1/5000 sf	in-place density and moisture content
Asphalt	finished	AASHTO T 230	1/5000 sf	in-place density

D. Parking Area Field Testing:

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Subgrade Subgrade	source random	AASHTO T 45 AASHTO T 238	1/soil class 1/2500 sf or 8-inch lift	AASHTO soil in-place density
Subbase Base pattern	random	AASHTO T 238	1/2500 sf	in-place density and moisture content
Asphaltic pattern	random	AASHTO T 230 ASTM D 2950	1/250 tons	in-place density

E. Building and Bridge Laboratory Testing:

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Structural	source	AASHTO T 99	1/soil class	moisture/density Fill
Structural Fill	source	AASHTO T 27	1/soil class	sieve analysis/ unified soil classification
Aggregate	underfloor	AASHTO T 27	1/source	sieve analysis
Embankment	source	AASHTO T 99	1/soil class	moisture/density relationship
Embankment	source	AASHTO T 27	1/soil class	sieve analysis
Concrete cylinder		ASTM C 39	1/set	cylinder compressive strength

F. Roads/Streets Laboratory Testing:

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Subbase/crusher or Base	stockpile	AASHTO T 27	1/1000 tons or 1/day	sieve analysis
Subgrade	embankment	AASHTO T 99 or T 180	1/soil class	moisture/density relationship
Subbase/source		AASHTO T 180	1/source	moisture/density relationship
Subbase/random Base		AASHTO T 27	1/1000 tons	sieve analysis
Asphalt Concrete	haul truck	AASHTO T 164 ASTM D 2172	1/250 tons	% asphalt in mix
Asphalt Concrete	haul truck	AASHTO T 27	1/250 tons	sieve analysis

G. Utility Trench:

<u>Item</u>	<u>Location</u>	<u>Reference</u>	<u>Frequency</u>	<u>Remarks</u>
Backfill	Trench	AASHTO T 238	1/150 lf of trench per lift	in place moisture/density

### 3.2 POST-TENSIONING OF CONCRETE

- A. Inspection Prior to Concreting: Inspect tendons, drape of tendons, and plates for compliance prior to concreting.

- B. Concrete Testing: As required in this section except make three test cylinders representing each area to be tensioned and cylinders shall be cured in the same manner as the concrete they represent. Make compression test prior to determine minimum specified strength required for post-tensioning.
- C. Post-tensioning: Observe post-tensioning operation and record actual force and elongation applied to each tendon.
- D. Submit a report for the following:
  - 1. Inspection of placement and post-tensioning of all strands.
  - 2. Size, number, location, and drape of strands and the post-tensioning loads imposed. Check elongation of tendons within ranges established by manufacturer.
- E. Compression Test Reports:
  - 1. Furnish certified compression test report to the Owners Representative. On test report indicate following information:
    - a. Cylinder identification number and date cast.
    - b. Specific location at which test samples were taken.
    - c. Type of concrete, slump, and percent air.
    - d. Compressive strength of concrete in psi.
    - e. Weight of lightweight structural concrete in pounds per cubic feet.
    - f. Weather conditions during placing.
    - g. Temperature of concrete in each test cylinder when test cylinder was molded.
    - h. Maximum and minimum ambient temperature during placing.
    - i. Ambient temperature when concrete sample in test cylinder was taken.
    - j. Date delivered to laboratory and date tested.

### 3.3 FLOOR SLABS

- A. Test flatness and levelness according to ASTM E 1155.

### 3.4 CONCRETE REINFORCEMENT

- A. Provide manufacturers mill certification and test report.

### 3.5 SHOTCRETE

- A. Inspection and Material Testing:
  - 1. Provide field inspection and testing service to certify that shotcrete has been applied according to drawings and specifications.
  - 2. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to the Owners Representative.
  - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
  - 4. Sample and test aggregates daily and as necessary for moisture content. Report instances of excessive moisture to the Owners Representative.
  - 5. Certify that ingredients and proportions and amounts of ingredients in shotcrete conform with approved trial mixes.
- B. Shotcrete Sampling:
  - 1. Provide a technician at site of placement to perform shotcrete sampling.
  - 2. Take cores according to ACI 506R.
  - 3. Insure maintenance of water-cement ratio established by approved trial mix.
  - 4. Verify specified mixing has been accomplished.
- C. Laboratory Tests of Field Sample Panels:



1. Test compression test core for strength according to ACI 506R. For each test series of three cores, test one core at 7 days and one core at 28 days. Use the remaining core as a spare to be tested at either 7 or 28 days as required. Compile laboratory test reports as follows: Compressive strength test shall be the result of one core, except when the one core shows evidence of improper sampling or testing, in which case it shall be discarded and strength of the spare core shall be used.
  2. Submit certified compression test reports to the Owners Representative. On the test report, indicate the following information:
    - a. Core identification number and date cast.
    - b. Specific location at which test samples were taken.
    - c. Compressive strength of shotcrete in psi.
    - d. Weather conditions during placing.
    - e. Temperature of shotcrete in each test core when test core was taken.
    - f. Maximum and minimum ambient temperature during placing.
    - g. Ambient temperature when shotcrete sample was taken.
    - h. Date delivered to laboratory and date tested.
- D. Submit inspection reports certification and instances of noncompliance to the Owners Representative.

### 3.6 MORTAR AND GROUT

- A. Take and test samples of mortar and grout according to ASTM C 91 for conformance with specified strength requirements.

### 3.7 STRUCTURAL STEEL

- A. Provide shop and field inspection and testing services to certify structural steel work is done in according to drawings and specifications.
  1. Welding shall conform with AWS D1.1 Structural Welding Code.
  2. Prefabrication Inspection:
    - a. Review design and shop detail drawings for size, length, type and location of all welds to be made.
    - b. Approve welding procedure qualifications either by prequalification or by witnessing qualifications tests.
    - c. Approve welder qualifications either by certification or retesting.
    - d. Approve procedure for control of distortion and shrinkage stresses.
    - e. Approve procedures for welding according to applicable portions of Section 4, AWS D1.1.
  3. Fabrication and Erection:
    - a. Inspect welding equipment for capacity, maintenance and working condition.
    - b. Verify specified electrodes and handling and storage of electrodes according to AWS D1.1
    - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
    - d. Inspect preheating and interpass temperatures for conformance with Table 4.2, AWS D1.1.
    - e. Verify that quality of welds meet the requirements of Paragraph 10.17, AWS D1.1. Verify quality of shop and field butt welds greater than 1/2 inch by ultrasonic procedure. Ultrasonic procedure shall conform to Section 6, Part C, AWS D1.1.
    - f. Correction of rejected welds shall be made in according to Paragraph 3.7, AWS D1.1.
    - g. Inspect high-strength bolted connections according to AISC M 017 using ASTM A 325 or A 490 bolts.

- B. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to the Owners Representative.

END OF SECTION

## SECTION 01 50 00

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

##### 1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
  - 1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.
- B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

~~C. Dust and HVAC Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:~~

- ~~1. Locations of dust control partitions at each phase of work.~~
- ~~2. HVAC system isolation schematic drawing.~~
- ~~3. Location of proposed air filtration system discharge.~~
- ~~4. Waste handling procedures.~~

~~5. Other dust control measures.~~

~~D.C.~~ Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

~~E.D.~~ Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

## 1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

~~D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.~~

~~E.D.~~ Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

## 1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

- C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.
- D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- ~~F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.~~
- ~~G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.~~
  - ~~1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.~~
- ~~H. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.~~
  - ~~1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.~~

Retain below for renovation work in occupied facilities.

- ~~I. Dust Control Adhesive Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).~~
- ~~J. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.~~

## 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site.
  - 2. Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.
  - 3. Drinking water and private toilet.
  - 4. Heating and cooling equipment necessary to maintain a uniform indoor.
  - 5. Lighting fixtures capable of maintaining average illumination at desk height.

- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

- 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

- 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

- ~~E. Air Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.~~

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.

- B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.

- C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  2. Connect temporary sewers to municipal system as directed by sewer department officials.
  3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
  4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. ~~Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.~~
- G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- H. ~~Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.~~
1. ~~Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.~~
    - a. ~~Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.~~
    - b. ~~Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.~~
  2. ~~Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.~~



~~3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.~~

~~J.H.~~ Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

~~J.I.~~ Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

~~K.J.~~ Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

~~L.K.~~ Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.

~~M.L.~~ Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

### 3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.

C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Coordinated parking with Owner's requirements.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
  3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Division 01 Section "Execution."
- ~~I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.~~
- ~~1. Do not load elevators beyond their rated weight capacity.~~
  - ~~2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.~~
- ~~J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.~~
- ~~1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.~~
- K.I. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- ~~1. Comply with work restrictions specified in Division 01 Section "Summary."~~
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- ~~I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.~~
- ~~J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.~~
- K.I. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.
- ~~L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.~~
  - ~~1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.~~
  - ~~2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.~~
    - ~~a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.~~
  - ~~3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.~~
  - ~~4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.~~
  - ~~5. Protect air-handling equipment.~~
  - ~~6. Provide walk-off mats at each entrance through temporary partition.~~

M.J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

### **3.5 MOISTURE CONTROL**

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard, replace, or clean stored or installed material that begins to show discoloration.
  - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Use permanent HVAC system to control humidity.
  - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

### **3.6 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

## SECTION 01 60 00

### PRODUCT REQUIREMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

##### 1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.

##### 1.3 SUBMITTALS

- A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

#### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

#### **1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 6. Protect stored products from damage and liquids from freezing.

#### **1.6 PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.



2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

## **PART 2 - PRODUCTS**

### **2.1 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  3. Products:
    - a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    - b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
  4. Manufacturers:
    - a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    - b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the

manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.
- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
  1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
  1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
  2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
  3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- A. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

## **2.2 COMPARABLE PRODUCTS**

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

## **PART 3 - EXECUTION**

### **3.1 RESTRICTION OF HAZARDOUS SUBSTANCES**

- A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.
- B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.
- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

## SECTION 01 73 00

### EXECUTION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  - 9. Correction of the Work.

##### 1.2 DEFINITIONS

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

##### 1.3 SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
  7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.
- A. Retention System Certification: Submit a statement certified by the Contractor's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.
1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Contractor's registered structural engineer's stamp, to the local building code official.
  2. Submit complete excavation support system shop drawings for information coordination purposes only.
  3. Architect/Engineer will neither review nor approve excavation support system shop drawings.

#### 1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and registered structural engineer shall be engaged by the Contractor.
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  3. Miscellaneous Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
    - a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

- E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## **1.5 WARRANTY**

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.



- C. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. Respective manufacturer/fabricator's written installation instructions.
  - 2. Accepted submittals.
  - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- A. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

### **3.4 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### **3.5 FIELD ENGINEERING**

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: 30 days after completion of each work component/activity, including, but not limited to, foundation walls, major site improvements, and other work requiring field-engineering

services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

- D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.6 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located, aligned, and coordinated with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.7 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching ~~according to requirements in Division 01 Section "Summary."~~
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
  - b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
- a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### **3.8 OWNER-INSTALLED PRODUCTS**

- A. Site Access: As applicable, provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### **3.9 PROGRESS CLEANING**

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers specifically intended for holding types of waste materials identified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.
- B. Site: Maintain Project site free of waste materials and debris.

- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills immediately.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.
- H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.10 STARTING AND ADJUSTING**

- A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

**3.11 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

## SECTION 01 74 16 – CLEANUP(SITE MAINTENANCE)

### 1.0 GENERAL

#### 1.1 DURING CONSTRUCTION

The Contractor shall at all times keep the job site as free from all materials, debris, and rubbish, as is practicable and shall remove same from any portion of the job site, when, in the opinion of the Owner, it becomes objectionable or interferes with the progress of the project.

#### 1.2 FINAL

Upon completion of the work, the Contractor shall remove from the site, material, tools and equipment belonging to him, and leave the site with an appearance acceptable to the Engineer.

1.2.1 Clean Equipment and Materials: The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver all such materials and equipment in a bright, clean, polished and new-appearing condition.

1.2.2 Restoration of Landscape Damage: Any landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Owner will decide what method of restoration shall be used.

1.2.3 Post-Construction Cleanup and Obliteration: The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials or any other vestiges of construction, as directed by the Owner.

1.2.4 Restoration of Roads/pavements: The Contractor shall be responsible for restoring all roads to driveable condition, equal to or greater than original condition.

1.2.5 Restoration of Fence: The Contractor shall be responsible for reconstructing all fences, removed or damaged during construction, to original condition.

END OF SECTION



## SECTION 01 74 19

### CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging and/or recycling nonhazardous demolition and construction waste.
  - 2. Disposing of nonhazardous construction waste.

##### 1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Salvage / Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

##### 1.4 SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons (tonnes).
  - 4. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
  - 5. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Submittal: Letter signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements have been met.

## **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.

## **1.6 WASTE MANAGEMENT PLAN**

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
  - 1. Total quantity of waste.
  - 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
  - 3. Total cost of disposal (with no waste management).
  - 4. Revenue from salvaged / recycled materials.
  - 5. Savings in hauling and tipping fees that are avoided.

6. Handling and transportation costs. Include cost of collection containers for each type of waste.
7. Net additional cost or net savings from waste management plan.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 PLAN IMPLEMENTATION**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### **3.2 RECYCLING CONSTRUCTION WASTE**

- A. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

### **3.3 DISPOSAL OF WASTE**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

## SECTION 01 77\_00

### CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.

##### 1.2 SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Certificates of Release: From authorities having jurisdiction.
- D. Certificate of Insurance: For continuing coverage.
- E. Field Report: For pest control inspection.
- F. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

##### 1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request, in writing, reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.
- E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

#### **1.4 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

### **1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the format agreed upon by the Owner and Architect.

### **1.6 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within minimum number days, as required by the Contract, of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## **PART 3 - EXECUTION**

### **3.1 FINAL CLEANING**

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations, as applicable, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Remove all graffiti and construction writing.
    - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive and as follows:
  - 1. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace all lamps and starters to comply with requirements for new fixtures.
- C. All Warranties remain in effect.

END OF SECTION



## SECTION 01 78 23

### OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

##### 1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

##### 1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and before commencing demonstration and training. Architect will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual prior to commencing demonstration and training.

## **PART 2 - PRODUCTS**

### **2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY**

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### **2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Architect.
  7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

## **2.3 EMERGENCY MANUALS**

- A. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## **2.4 OPERATION MANUALS**

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.

3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.

5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## **2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

### **PART 3 - EXECUTION**

#### **3.1 MANUAL PREPARATION**

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

## SECTION 01 78 39

### PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.

##### 1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record.
      - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned record.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

#### PART 2 - PRODUCTS

##### 2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

##### 2.2 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
  - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - b. Accurately record information in an acceptable drawing technique.
  - c. Record data as soon as possible after obtaining it.
  - d. Record and check the markup before enclosing concealed installations.
  - e. Cross-reference record prints to corresponding archive photographic documentation.
  
2. Content: Types of items requiring marking include, but are not limited to, the following:
  - a. Dimensional changes to Drawings.
  - b. Revisions to details shown on Drawings.
  - c. Depths of foundations below first floor.
  - d. Locations and depths of underground utilities.
  - e. Revisions to routing of piping and conduits.
  - f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made by Change Order or Construction Change Directive.
  - k. Changes made following Architect's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
  
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

### **2.3 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. Note related Change Orders, record Product Data, and record Drawings where applicable.
  
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.



## **2.4 RECORD PRODUCT DATA**

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## **2.5 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

## **PART 3 - EXECUTION**

### **3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

## SECTION 01 79 00

### DEMONSTRATION AND TRAINING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.

##### 1.2 SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

##### 1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

##### 1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  - 4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.

- j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### **3.2 INSTRUCTION**

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner with at least seven days' advance notice.

- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

## SECTION 02 41 13 - DEMOLITION

### 1.0 GENERAL

#### 1.1 DESCRIPTION

The section covers the demolition or removal of any existing structures, pavement, curb & gutter, or other improvements that may interfere with the proposed construction and/or designated to be removed.

### 2.0 EXECUTION

#### 2.1 DEMOLITION

The items identified or conflicting shall be removed before performing final site grading. Demolition shall be performed in a manner to insure no interruption in service to the existing facilities. Contractor shall be responsible for insuring that any temporary services or replacement services have been installed prior to removals. Maintenance of access shall be coordinated with the Owner.

Items to be salvaged or delivered to the Owner shall be removed in such a way to minimize damage and maintain functionality for future use.

All paving shall be removed by full depth sawcuts, unless otherwise noted, to provide a flush surface for new adjoining construction.

#### 2.2 DISPOSAL

Contractor shall be responsible for removal and disposal of all existing equipment, structures, paving, and other materials scheduled for demolition or removal. Contractor shall be responsible for transporting and proper disposal of items scheduled to be removed from site. Disposal shall be in accordance with all Federal, State, and Local regulations that may govern.

Any equipment or items to be retained by the Owner shall be removed and placed at a location designated by the Owner. Disposal of concrete and other debris scheduled to be completely removed shall be the responsibility of the Contractor.

Items that are to be removed and salvaged and/or delivered to Owner shall be either delivered to a storage location on-site or to a location to be determined by the Owner. Salvaged material/items shall be removed, handled, and transported in a manner to minimize damage.

#### 2.3 DEPTH OF DEMOLITION OR REMOVAL

It shall be the responsibility of the Contractor to insure that all items to be demolished or removed are done so to a level below grade in such a manner as to permit the construction of all improvements.

END OF SECTION

## SECTION 02 41 19

### SELECTIVE DEMOLITION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes selective removal and subsequent offsite disposal of portions of existing building indicated on drawings and as required to accommodate new construction.

##### 1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner's designated storage area.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

##### 1.3 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.
- B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Locations of temporary partitions and means of egress.
  - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

- E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## 1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for demolitions similar to this Project and has a record of successful in-service performance.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with applicable regulations, codes and ordinances.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
  1. Inspect and discuss condition of construction to be selectively demolished.
  2. Review structural load limitations of existing structure.
  3. Review and finalize selective demolition schedule.
  4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

## 1.6 PROJECT CONDITIONS

### ~~A. Occupied Buildings:~~

- ~~1. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.~~
- ~~2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.~~

~~B.A.~~ Owner assumes no responsibility for condition of areas to be selectively demolished. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

~~C.B.~~ Hazardous Materials: If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

~~D.C.~~ Storage or sale of removed items or materials on-site will not be permitted.

~~E.D.~~ Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.



## 1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- ~~B. Occupied Buildings: Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.~~
  - ~~1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.~~

C.B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Arrange with Owner to shut off indicated utilities.
2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

### **3.3 PREPARATION**

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furnishings, and equipment that have not been removed.

C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of selective demolition.

### **3.4 POLLUTION CONTROLS**

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
  2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### 3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
  3. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents before starting flame-cutting operations.
  6. Maintain portable fire-suppression devices during flame-cutting operations.
  7. Maintain adequate ventilation when using cutting torches.
  8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  11. Dispose of demolished items and materials promptly.
  12. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

~~B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.~~

~~C.B.~~ Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

~~D.C.~~ Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E.D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### **3.6 PATCHING AND REPAIRS**

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
  1. Completely fill holes and depressions in existing concrete or masonry that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

### **3.7 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### **~~3.8~~ SELECTIVE DEMOLITION SCHEDULE**

- ~~A. Refer to the drawings.~~

END OF SECTION

## **SECTION 031000**

### **CONCRETE FORMING AND ACCESSORIES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Form-facing material for cast-in-place concrete.
  - 2. Shoring, bracing, and anchoring.

##### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site .

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each of the following:
  - 1. Exposed surface form-facing material.
  - 2. Concealed surface form-facing material.
  - 3. Form ties.
  - 4. Waterstops.
  - 5. Form-release agent.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
  - 1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
  - 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
    - a. Location of construction joints is subject to approval of the Architect.
  - 3. Indicate location of waterstops.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. Minutes of preinstallation conference.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

### **2.2 FORM-FACING MATERIALS**

#### **A. As-Cast Surface Form-Facing Material:**

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
  - a. Plywood, metal, or other approved panel materials.
  - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - 1) APA HDO (high-density overlay).
    - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
    - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
    - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

### **2.3 RELATED MATERIALS**

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF FORMWORK**

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .
- C. Limit concrete surface irregularities as follows:
  1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
  2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
  3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
  1. Minimize joints.
  2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
  1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
  2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
  1. Provide and secure units to support screed strips.
  2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
  1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
  2. Locate temporary openings in forms at inconspicuous locations.

- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
  - 1. Determine sizes and locations from trades providing such items.
  - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
  - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
  - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 3. Place joints perpendicular to main reinforcement.
  - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
    - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 6. Space vertical joints in walls as indicated on Drawings .
    - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
  - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
  - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.



2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

### **3.3 INSTALLATION OF WATERSTOPS**

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
  1. Install in longest lengths practicable.
  2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
  3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-In-Place Concrete."
  4. Secure waterstops in correct position at 12 inches on center.
  5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
    - a. Miter corners, intersections, and directional changes in waterstops.
    - b. Align center bulbs.
  6. Clean waterstops immediately prior to placement of concrete.
  7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
  1. Install in longest lengths practicable.
  2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
  3. Protect exposed waterstops during progress of the Work.

### **3.4 SHORING AND RESHORING INSTALLATION**

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### **3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
  - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
  - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

**SECTION 03 20 00**  
**CONCRETE REINFORCING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Steel reinforcement bars.
  2. Welded-wire reinforcement.

**1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For the following:
1. Each type of steel reinforcement.
  2. Bar supports.
- B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
  2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.5 QUALITY ASSURANCE**

**PART 2 - PRODUCTS**

**2.1 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.

- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

## **2.2 REINFORCEMENT ACCESSORIES**

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
    - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
    - e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

## **2.3 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

### **3.2 INSTALLATION OF STEEL REINFORCEMENT**

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
  - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  - 2. Do not tack weld crossing reinforcing bars.

- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
  - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
  - 2. Stagger splices in accordance with ACI 318.
  - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
  - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
  - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
  - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
  - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  - 4. Lace overlaps with wire.

### **3.3 JOINTS**

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement.
  - 2. Continue reinforcement across construction joints unless otherwise indicated.
  - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

### **3.4 INSTALLATION TOLERANCES**

- A. Comply with ACI 117.

### **3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
  - 1. Steel-reinforcement placement.

2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

END OF SECTION

## SECTION 033000

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

##### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

##### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:
  - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
5. Vapor retarders.

6. Curing materials.
7. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

## **1.5 INFORMATIONAL SUBMITTALS**

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

C. Field quality-control reports.

D. Minutes of preinstallation conference.

## **1.6 QUALITY ASSURANCE**

### **1.7 DELIVERY, STORAGE, AND HANDLING**

A. Comply with ASTM C94/C94M and ACI 301.



## **1.8 FIELD CONDITIONS**

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

### **2.2 CONCRETE MATERIALS**

- A. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M, Type I/II , gray .
  - 2. Fly Ash: ASTM C618, Class C or F.
  - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Alkali-Silica Reaction: Comply with one of the following:
    - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
    - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
    - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
  - 2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable

### **2.3 VAPOR RETARDERS**

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

### **2.4 CURING MATERIALS**

- A. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
1. Color:
    - a. Ambient Temperature Below 50 deg F: Black.
    - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
    - c. Ambient Temperature Above 85 deg F: White.
- B. Water: Potable or complying with ASTM C1602/C1602M.

### **2.5 RELATED MATERIALS**

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Floor Slab Protective Covering: Eight-feet- wide cellulose fabric.

### **2.6 CONCRETE MIXTURES, GENERAL**

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
  2. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
  3. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete with a w/cm below 0.50.

## 2.7 CONCRETE MIXTURES

- A. Class A : Normal-weight concrete used for footings, grade beams, and tie beams.
1. Exposure Class: ACI 318 F0 S0 W0 C1 .
  2. Minimum Compressive Strength: 3000 psi at 28 days.
  3. Maximum w/cm: 0.55 .
  4. Slump Limit: 5 inches , plus or minus 1 inch .
  5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- B. Class B : Normal-weight concrete used for foundation walls.
1. Exposure Class: ACI 318 F1 W0 C1 .
  2. Minimum Compressive Strength: 3500 psi at 28 days.
  3. Maximum w/cm: 0.45 .
  4. Slump Limit: 5 inches , plus or minus 1 inch .
  5. Air Content:
    - a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size .
  6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- C. Class C : Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 F0 S0 W0 C0 .
  2. Minimum Compressive Strength: 3500 psi at 28 days.
  3. Maximum w/cm: 0.45 .
  4. Slump Limit: 5 inches , plus or minus 1 inch .
  5. Air Content:
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
  6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
  - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### **3.2 INSTALLATION OF VAPOR RETARDER**

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
  - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  - 7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

### **3.3 JOINTS**

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  - 2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
    - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  6. Space vertical joints in walls as indicated on Drawings . Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

### **3.4 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
  2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  3. Maintain reinforcement in position on chairs during concrete placement.
  4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  5. Level concrete, cut high areas, and fill low areas.
  6. Slope surfaces uniformly to drains where required.
  7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  8. Do not further disturb slab surfaces before starting finishing operations.

### **3.5 FINISHING FORMED SURFACES**

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
  - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
  - b. Remove projections larger than 1 inch.
  - c. Tie holes do not require patching.
  - d. Surface Tolerance: ACI 117 Class D.
  - e. Apply to concrete surfaces not exposed to public view .
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/4 inch.
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 Class B.
  - e. Locations: Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete .
3. ACI 301 Surface Finish SF-3.0:
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/8 inch.
  - c. Patch tie holes.

- d. Surface Tolerance: ACI 117 Class A.
- e. Locations: Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete .

B. Related Unformed Surfaces:

- 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
- 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### **3.6 FINISHING FLOORS AND SLABS**

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:

- 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
- 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
- 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
- 4. Do not add water to concrete surface.
- 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
- 6. Apply a trowel finish to surfaces exposed to view or .
- 7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch .

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

- 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
- 2. Coordinate required final finish with Architect before application.

### **3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS**

A. Filling In:

- 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
- 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
- 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 3500 psi at 28 days.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  - 6. Prior to pouring concrete, place and secure anchorage devices.
    - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - b. Cast anchor-bolt insert into bases.
    - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

### **3.8 CONCRETE CURING**

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  - 3. If forms remain during curing period, moist cure after loosening forms.
  - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - b. Continuous Sprinkling: Maintain concrete surface continuously wet.



- c. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
  - d. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
    - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
    - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
- 1. Begin curing immediately after finishing concrete.
  - 2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - b) Cure for not less than seven days.
      - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
      - 1) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - b) Cure for not less than seven days.
      - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - c. Floors to Receive Polished Finish: Contractor has option of the following:
      - 1) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - d. Floors to Receive Chemical Stain:
      - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
    - e. Floors to Receive Urethane Flooring:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
  - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
  - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors to Receive Curing Compound:
- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- g. Floors to Receive Curing and Sealing Compound:
- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### **3.9 TOLERANCES**

- A. Conform to ACI 117.

### **3.10 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - 1) Project name.

- 2) Name of testing agency.
- 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
- 4) Name of concrete manufacturer.
- 5) Date and time of inspection, sampling, and field testing.
- 6) Date and time of concrete placement.
- 7) Location in Work of concrete represented by samples.
- 8) Date and time sample was obtained.
- 9) Truck and batch ticket numbers.
- 10) Design compressive strength at 28 days.
- 11) Concrete mixture designation, proportions, and materials.
- 12) Field test results.
- 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
- 14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
  - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
  - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .

- a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
  6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C31/C31M:
    - a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
    - b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.
  8. Compressive-Strength Tests: ASTM C39/C39M.
    - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
    - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
  11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  12. Additional Tests:
    - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
      - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
  13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

### **3.11 PROTECTION**

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

**SECTION 042200**  
**CONCRETE UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Concrete masonry units.
  - 2. Steel reinforcing bars.

**1.2 DEFINITIONS**

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Material Certificates: For each type and size of product. For masonry units, include data on material properties .
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  - 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

## **1.5 QUALITY ASSURANCE**

## **1.6 FIELD CONDITIONS**

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## **PART 2 - PRODUCTS**

### **2.1 UNIT MASONRY, GENERAL**

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

### **2.2 CONCRETE MASONRY UNITS**

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units .
- C. CMUs: ASTM C90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi .
  - 2. Density Classification: Lightweight .

## **2.3 CONCRETE LINTELS**

- A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

## **2.4 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Aggregate for Mortar: ASTM C144.
  - 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
  - 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C404.
- G. Water: Potable.

## **2.5 REINFORCEMENT**

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
  - 1. Interior Walls: Mill- galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon steel.
  - 3. Wire Size for Side Rods: 0.148-inch diameter.
  - 4. Wire Size for Cross Rods: 0.148-inch diameter.
  - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
  - 6. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.



## **2.6 TIES AND ANCHORS**

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
  2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
  3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized-steel wire.
  2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized-steel wire.

## **2.7 MISCELLANEOUS MASONRY ACCESSORIES**

## **2.8 MORTAR AND GROUT MIXES**

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
  2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
  3. For exterior masonry, use portland cement-lime or masonry cement mortar.
  4. For reinforced masonry, use portland cement-lime or masonry cement mortar.
  5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For reinforced masonry, use Type S .
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
- E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

### **3.2 TOLERANCES**

- A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

- B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

- C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

### **3.3 LAYING MASONRY WALLS**

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### **3.4 MORTAR BEDDING AND JOINTING**

- A. Lay hollow CMUs as follows:
  1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  3. Bed webs in mortar in grouted masonry, including starting course on footings.
  4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

### **3.5 MASONRY-JOINT REINFORCEMENT**

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
  2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### **3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE**

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

### **3.7 FLASHING**

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

### **3.8 REINFORCED UNIT MASONRY**

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches .

### **3.9 FIELD QUALITY CONTROL**

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level B in TMS 402/ACI 530/ASCE 5.
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.

- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at seven days and at 28 days.

### **3.10 REPAIRING, POINTING, AND CLEANING**

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
  - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

### **3.11 MASONRY WASTE DISPOSAL**

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

## **SECTION 051200**

### **STRUCTURAL STEEL FRAMING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.

##### **1.2 DEFINITIONS**

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

##### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

##### **1.4 ACTION SUBMITTALS**

- A. Shop Drawings: Show fabrication of structural-steel components.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Field quality-control reports.

##### **1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE .
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303.
  - 2. ANSI/AISC 360.
  - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
  - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
  - 2. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
    - a. Select and complete connections using schematic details indicated and ANSI/AISC 360 <Insert source>.
    - b. Use Allowable Stress Design; data are given at service-load level.
  - 3. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
    - a. Use Allowable Stress Design; data are given at service-load level.
  - 4. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
    - a. Use Allowable Stress Design; data are given at service-load level.
- C. Moment Connections: Type FR, fully restrained.
- D. Construction: Moment frame .

### **2.2 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A992/A992M .
- B. Channels, Angles : ASTM A36/A36M .
- C. Plate and Bar: ASTM A36/A36M .
- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.



- E. Welding Electrodes: Comply with AWS requirements.

## **2.3 BOLTS AND CONNECTORS**

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1**, compressible-washer type with plain finish.

## **2.4 RODS**

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36 .
  - 1. Configuration: Straight .
  - 2. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .
- B. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight.
  - 1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .
- C. Threaded Rods: ASTM A36/A36M .
  - 1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C .

## **2.5 PRIMER**

- A. Steel Primer:
  - 1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings." Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
  - 2. SSPC-Paint 23, latex primer.
  - 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: MPI#26 MPI#80, MPI#134.
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 .

## **2.6 SHRINKAGE-RESISTANT GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
- B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

## 2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

## 2.10 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces unless indicated to be painted.
  - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 7 (WAB)/NACE WAB-4.
  - 4. SSPC-SP 6 (WAB)/NACE WAB-3.

- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## **2.11 SOURCE QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E165/E165M.
    - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E164.
    - d. Radiographic Inspection: ASTM E94/E94M.
  - 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
  - 5. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

### **3.3 FIELD CONNECTIONS**

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

### **3.4 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
  2. Verify weld materials and inspect welds.
  3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION

**SECTION 053100**  
**STEEL DECKING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Roof deck.

**1.2 ACTION SUBMITTALS**

- A. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- B. Qualification Statements: For welding personnel and testing agency.

**1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:
    - a. AWS D1.3/D1.3M.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

### **2.2 ROOF DECK**

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
  - 1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Manufacturer's standard .
  - 2. Deck Profile: Type WR, wide rib .
  - 3. Profile Depth: As indicated .
  - 4. Design Uncoated-Steel Thickness: As indicated .
  - 5. Span Condition: As indicated .
  - 6. Side Laps: Overlapped .

### **2.3 ACCESSORIES**

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

### **3.2 INSTALLATION OF ROOF DECK**

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch , nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in Zone 1 and 6 inches apart in Zones 2 and 3, based on roof-area definitions in FM Global Loss Prevention Data Sheet 1-28 .
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches , and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. Mechanically clinch or button punch.
  - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum .
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and weld .
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.



### **3.3 INSTALLATION OF FLOOR DECK**

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 5/8 inch , nominal.
  - 2. Weld Spacing:
    - a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches apart, but not more than 18 inches apart.
    - b. Space and locate welds as indicated.
  - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. Mechanically clinch or button punch.
  - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches , with end joints as follows:
  - 1. End Joints: Lapped .
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### **3.4 REPAIR**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
  - 1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
  - 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
  - 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
    - a. Field welds will be subject to inspection.
  - 2. Steel decking will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

## SECTION 07 14 16

### COLD FLUID-APPLIED WATERPROOFING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Cold fluid-applied latex-rubber waterproofing system and supplementary items necessary for installation at the following applications:
  - 1. Vertical positive side applications at foundation walls.
  - 2. Vertical positive side applications at planters.
  - 3. Horizontal positive side applications at above grade split slabs.
  - 4. Horizontal positive side applications at earth covered horizontal decks.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product or system indicated.
  - 1. Include manufacturer's specifications for materials and installation instructions.
  - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details for each condition encountered in Work, including, but not limited to, substrate joint and crack treatments, waterproofing applications, flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples for Verification Purposes: Actual samples for each of following in manufacturer's standard sizes:
  - 1. Waterproofing Membrane: Cured membrane on solid backing layered to indicate various components, including reinforcing.
  - 2. Drainage Panel.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Pre-Construction Test Report: Written reports of manufacturer's testing required by "Quality Assurance" Article.
- D. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- E. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

F. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

#### 1.4 QUALITY ASSURANCE

~~A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.~~

B.A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C.B. Pre-Construction Subsoil Water Testing:

1. General Requirements: Test subsoil water for compatibility with waterproofing materials.
2. Test Method: Use manufacturer's standard test method to test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
3. Specimen Quantity: Obtain and submit as many subsoil water samples required from Project at approximate locations where waterproofing will be installed.
4. Reports: Interpret test results and certify reports indicating requirements for use of waterproofing materials and for corrective measures necessary.

D.C. Mock-Ups: Before beginning Work of this Section, install minimum **100 sf (9.3 sm)** of waterproofing system using materials indicated for the completed Work; incorporating substrate construction, sealing at penetrations, and seaming to demonstrate installation of system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.

1. Demonstrate surface preparation, crack, joint, and corner treatments.
2. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
3. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.

#### 1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
  - a. Architect.
  - b. Contractor, including superintendent.
  - c. Installer, including project manager and supervisor.
  - d. If requested, Manufacturer's qualified technical representative.
  - e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
  - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
  - b. Review Contract Document requirements.
  - c. Review approved submittals.
  - d. Review inspection and testing requirements.
  - e. Review environmental conditions and procedures for coping with unfavorable conditions.
  - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

## **1.7 PROJECT CONDITIONS**

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by manufacturer. Do not apply waterproofing to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

## **1.8 COORDINATION**

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

## **1.9 WARRANTY**

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
  1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS AND PRODUCTS**

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

~~B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.~~

~~C.B.~~ Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

### **2.2 MATERIALS, GENERAL**

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

### **2.3 COLD FLUID-APPLIED WATERPROOFING MATERIALS**

A. Cold Fluid-Applied Waterproofing: ASTM C 836; two component, high solids, reinforced, coal-tar free, chemically cured, latex-rubber that when cold liquid applied forms a seamless, impervious, elastomeric membrane bonded to substrate.

1. Manufacturer and Product: GCP Applied Technologies, Inc.; Procor Deck System 3R.

### **2.4 ACCESSORY MATERIALS**

A. General: Furnish accessory materials recommended by waterproofing system manufacturer for intended use and compatible with waterproofing.

B. Primer: Factory-formulated primer provided by waterproofing manufacturer.

C. Sheet Flashing: 50 mils (1.3 mm) minimum thickness, non-staining, uncured sheet neoprene and contact adhesive provided by waterproofing manufacturer.

D. Membrane-Reinforcing Fabric: Nonwoven, needle-punched white polyester fabric, weight required for application, provided by waterproofing manufacturer.

E. Joint Reinforcing Strip: Fiberglass mesh or polyester fabric provided by waterproofing manufacturer.

F. Joint Sealant: Product provided by or recommended by waterproofing manufacturer for substrate and joint conditions:

1. Sealant Product Quality Standard: ASTM C 920 Type M, Class 25, Grade NS for sloping and vertical applications or Grade P for deck applications, Use NT exposure.
2. Sealant Description: Multi-component polyurethane sealant compatible with water-proofing.

3. Backer Rod: Closed cell polyethylene foam.

~~2.5 Root Barrier: High density polyethylene sheet, 15 mil thickness, root barrier designed to provide total root protection for waterproofing membrane.~~

~~2.6 Basis of Design: American Hydrotech, Inc., Root Stop WSF 40~~

## 2.72.5 MOLDED-SHEET DRAINAGE PANELS

### A. Molded-Sheet Drainage Panels; Vertical Applications:

1. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
2. Protective Covering: Smooth polymeric film.
3. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
  - a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
  - b. Minimum In-Plane Flow Rate: 15 gpm/ft (188 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.
4. Geotextile Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:
  - a. Survivability: Class 2.
  - b. Permittivity: 0.1 per second, minimum.
5. Manufacturers and Products:
  - a. American Hydrotech; Hydrodrain 420.
  - b. American Wick Drain Corporation; AmeriDrain 520.
  - c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
  - d. GCP Applied Technologies, Inc.; Hydroduct 220.
  - e. Henry Company; DB 520.
  - f. JDR Enterprises, Inc.; J-Drain 420.
  - g. Polyguard Products, Inc.; Flow 15P
  - h. Tremco Commercial Sealants & Waterproofing; TREMDrain 1000.

### B. Molded-Sheet Drainage Panels; Horizontal Applications:

1. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
2. Protective Covering: Smooth polymeric film.
3. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
  - a. Minimum Compressive Strength: 18,000 lbf/sf (862 kPa) according to ASTM D 1621.
  - b. Minimum In-Plane Flow Rate: 18 gpm/ft (225 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.

4. Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:
  - a. Survivability: Class 2.
  - b. Permittivity: 0.1 per second, minimum.
5. Manufacturers and Products:
  - a. American Hydrotech, Inc.; Hydrodrain 700
  - b. American Wick Drain Corporation; AmeriDrain 654.
  - c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 9800.
  - d. GCP Applied Technologies, Inc.; Hydroduct 660.
  - e. Henry Company; DB 650n with G100s/s base/protection sheet.
  - f. Polyguard Products, Inc.; Flow 18-H.
  - g. Tremco Commercial Sealants & Waterproofing; TREMDrain 2000.
- C. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.
- D. Miscellaneous Accessories: As required by manufacturer for complete installation assembly, including flanges around piping penetrations and expanded base and tie-in fittings as necessary to coordination with foundation drainage system.
- ~~E. Foundation Drainage System: As specified in Division 33 Section "Foundation Drainage System".~~

#### 2-82.6 BOARD INSULATION

- A. Extruded Polystyrene Board Insulation: As specified in Division 07 Section "Thermal Insulation".

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

#### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  1. Vertical Applications: ASTM C 1471.
  2. Horizontal Applications: ASTM C 898.
  3. Respective manufacturer's written installation instructions.
  4. Accepted submittals.
  5. Contract Documents.



### 3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Excavation Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water again.
- C. Concrete Surfaces:
  - 1. Verify concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or as recommended by roofing manufacturer.
  - 3. Remove fins, ridges, mortar, and other projections.
  - 4. Verify honeycomb voids, rock pockets, form tie holes, and other defects are filled by other Division 03 Sections.
  - 5. Remove dust and dirt from joints and cracks according to ASTM D 4258.
  - 6. Remove debris, oily substances, mud, grease, oil, bitumen, form-release agents, paints, curing compounds, penetrating contaminants or film-forming coatings from concrete, and similar substances.

### 3.4 COLD FLUID-APPLIED WATERPROOFING INSTALLATION

- A. General Installation Performance Requirements: Install waterproofing system to prevent passage of liquid water under hydrostatic pressure.
- B. Joint and Crack Treatment: Prepare, treat, rout, and fill joints and cracks in substrate according to installation quality standards.
- C. Primer: Apply to substrates at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing in same day. Reprime areas exposed for more than 24 hours.
- D. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.
- E. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to installation quality standards.
- F. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.
  - 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases, with an average dry film total thickness required by manufacturer.
  - 2. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
  - 3. Verify wet film thickness of waterproofing every 100 sf (9.3 sm).
- G. Curing: Cure waterproofing taking care to prevent contamination and damage during application stages and curing.

- H. Damaged Waterproofing: Repair waterproofing not complying with requirements.

### 3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Installation: Place and secure molded-sheet drainage panels with adhesive, with geotextile filter fabric facing away from waterproofing. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

### 3.6 BOARD INSULATION INSTALLATION

- A. Extruded Polystyrene Board Insulation: As specified in Division 07 Section "Thermal Insulation".

### 3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

- C. Testing: Provide one of the following testing methods:

1. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing and flashing, but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

- a. Flood to an average depth of 2-1/2 in (65 mm) with a minimum depth of 1 in (25 mm) and not exceeding a depth of 4 in (100 mm). Maintain minimum of 2 in (50 mm) of clearance from top of base flashing.
- b. Flood each area for 24 hours.
- c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installation is watertight.

2. Electronic Water Testing, Electronic Field Vector Mapping (EFVM): Perform leak testing by an electronic detection process to verify entire waterproofing membrane is free of holes, open seams, and capillary defects that allow water to pass. Administer EFVM by a qualified testing agency as follows:

- a. Leak detection of horizontal waterproofing membrane shall be done prior to placement of protection board and remaining system components.
  - 1) Place conductor wire on bare membrane. Secure wire with small strips of waterproofing or other compatible membrane or tape.
  - 2) Thoroughly wet waterproofing membrane with potable water in area of test. Wetting can be accomplished by hand or mechanical spray devices. Membrane shall be wet during testing procedures.

- 3) Technician shall mark on waterproofing membrane or surface exact location of defect and assign an identification number to each location.
  - 4) Visually inspect entire waterproofing membrane area and repair breaches found. An EFVM retest shall be performed to confirm integrity of repair(s).
- b. Technician shall prepare a report of each day's test results containing a written description and photograph of defect(s) located and a schematic CAD drawing indicating location of conductor wire and of defect(s) located in testing field to within **1 in (25 mm)** of accuracy. This report shall be made available in hard copy.
  - c. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing membrane in event of an unsuccessful test.
  - d. Materials and installations failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- D. Correction of Deficiencies: Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair flashing.
1. After tests, repair leaks and make further repairs until waterproofing installation is watertight.
- E. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

### **3.8 CLEANING AND PROTECTION**

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

## SECTION 07 19 00

### WATER REPELLENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes penetrating water repellent and supplementary items necessary to complete work required for its installation.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
  - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.
- E. Certification by water repellent manufacturer that products supplied complies with local regulations controlling use of VOCs.
- F. Warranty: Sample of warranty.
  - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

##### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
  - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
  - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

- B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.
- C. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.
- D. Field Samples: Select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.
  - 1. Obtain approval of field samples before applying water repellents.
  - 2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

### **1.5 PRE-INSTALLATION CONFERENCE**

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

### **1.6 PROJECT CONDITIONS**

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:
  - 1. Ambient temperature is less than 40 deg F (4.4 deg C).
  - 2. Concrete surfaces have cured for less than 28 days.
  - 3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
  - 4. Application is earlier than 24 hours after surfaces have been wet.
  - 5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
  - 6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

### **1.7 COORDINATION**

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

### **1.8 WARRANTY**

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
  - 1. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 in (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.
  - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Advanced Chemical Technologies, Inc.
2. Anti Hydro International, Inc
3. L&M Construction Chemicals, Inc.
4. Nox-Crete Products Group
5. PROSOCO, Inc.
6. Textured Coatings of America, Inc.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens, per ASTM C642.
  2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
  3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
  4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
  5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
  6. Chloride-Ion Intrusion in Horizontal Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.
    - a. Reduction of Water Absorption: 80 percent.
    - b. Reduction in Chloride Content: 80 percent.

### **2.3 WATER REPELLENTS**

- A. Vertical Applications: Silane, 20 Percent Solids: Penetrating water repellent for vertical application. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes and meeting VOC/AIM regulations containing 3.3 lb./gal. VOCs or less.
- B. Horizontal Applications: Silane, 40 Percent Solids: Penetrating water repellent for horizontal application. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes and meeting VOC/AIM regulations containing 3.3 lb./gal. VOCs or less.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates surfaces to receive water repellents and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. Respective manufacturer written installation instructions.
  - 2. Accepted submittals.
  - 3. Contract Documents.

### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work
- B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.
- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
  - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

### **3.4 APPLICATION**

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
  - 1. Architectural Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

### **3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

### **3.6 CLEANING**

- A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

### **3.7 SCHEDULE**

- A. Apply water repellents to following areas:
  1. Architectural precast concrete panels.

END OF SECTION



## SECTION 07 26 17

### BELOW SLAB VAPOR RETARDERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Below slab vapor retarders and supplementary items necessary for installation.
- B. Adhered and Specialty Floor Finishes at Slab-on-Grade Areas: Refer to floor finish section(s) for concrete moisture barrier treatment at adhered floorings, thin-set terrazzo and wood flooring systems.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
  - 1. Include manufacturer's specifications for materials, construction details, installation instructions, and recommendations for maintenance.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.
- C. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.
- D. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

##### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
  - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
  - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
  - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Mock-Ups: Prior to beginning Work of this Section, install minimum 150 sf (14 sq m) mock-up

of below slab vapor retarder using materials indicated for the completed Work; incorporating subgrade construction, sealing at penetrations, and seaming to demonstrate installation of below slab vapor retarder system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.

## **1.5 PRE-INSTALLATION CONFERENCE**

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
  - a. Architect.
  - b. Contractor, including superintendent.
  - c. Installer, including project manager and supervisor.
  - d. If requested, Manufacturer's qualified technical representative.
  - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
  - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
  - b. Review Contract Document requirements.
  - c. Review approved submittals.
  - d. Review inspection and testing requirements.
  - e. Review environmental conditions and procedures for coping with unfavorable conditions.
  - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

## **1.6 PROJECT CONDITIONS**

A. Ambient Conditions: Install below slab vapor retarder within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

## **1.7 COORDINATION**

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS AND PRODUCTS**

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section

"Substitution Procedures".

- B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

## 2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

## 2.3 BELOW SLAB VAPOR RETARDERS

- A. Vapor Retarder for Typical Concrete Slab-on-Grade Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible, lightweight material manufactured from raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted); not less than **15 mil (0.4 mm)** thick.
3. Manufacturers and Products:
  - a. Barrier-Bac; VB-350
  - b. Fortifiber Building Product Systems; Moistop Ultra 15
  - c. Insulation Solutions, Inc.; Viper VaporCheck II 15
  - d. W. R. Meadows, Inc.; Perminator, 15-mil
  - e. Poly-America; Husky Yellow Guard 15 mil
  - f. Raven Industries; VaporBlock 15
  - g. Reef Industries, Inc.; Griffolyn 15-mil Green
  - h. Stego Industries LLC; Stego Wrap, 15-mil
  - i. Tex-Trude, LP; Xtreme Vapor Barrier, 15-mil

- B. Vapor Retarder for Structured Concrete Slab Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible or semi-flexible, material manufactured of one of following compositions; with one face suited for integral bonding with concrete; not less than **20 mil (0.05 mm)** thick.
  - a. Raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted).
  - b. Multiple ply board composed of a proprietary core with bituminous impregnated material and glass-mat liners, with polyethylene facers.
3. Manufacturers and Products:
  - a. Barrier-Bac; VBC-350
  - b. Grace Construction Products; Florprufe 120
  - c. W. R. Meadows, Inc.; Premoulded Membrane Vapor Seal with Plasmatic Core (PMCP), with felt face toward concrete
  - d. Polyguard Products, Inc.; Underseal

## 2.4 ACCESSORIES

- A. Barrier Seaming and Sealing Tape: Manufacturer's standard one-sided or two-sided pressure-sensitive tape of type, material and size for sealing membrane joints and for sealing membrane to other adjacent structures; provided by vapor retarder manufacturer.

- B. Penetration Accessories: Manufacturer's standard pre-molded products or mastic for sealing penetrations; provided by vapor retarder manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine subgrade and foundation surfaces to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

#### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
  1. ASTM E 1643, except place vapor retarder on top of granular fill.
  2. Respective manufacturer's installation written instructions.
  3. Accepted submittals.
  4. Contract Documents.

#### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and Project specifications for subgrade preparation. Subgrade surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work. Provide smooth, level, and properly compacted and moisture conditioned subgrade in accordance with Geotechnical Engineer's recommendations.
- B. Ensure that subgrade is smooth and even without sharp or protruding objects that might rip, tear, or puncture vapor retarder membrane.

#### **3.4 BELOW SLAB VAPOR RETARDER INSTALLATION**

- A. Install multiple sheets to form continuously sealed below slab vapor retarder over properly prepared subgrade prior to concrete slab reinforcing installation.
  1. Place vapor retarder membrane in widest width possible over subgrade with longest dimension parallel with direction of concrete placement with proper face toward concrete; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks.
  2. Properly dry and clean mating surfaces of vapor retarder membrane prior to application of seaming tape.
  3. Overlap sides and ends of vapor retarder membrane not less than **6 in (150 mm)** and apply seaming tape.
  4. Ensure vapor retarder membrane is continuous from edge to edge of concrete slab according to following:
    - a. Extend membrane out from under edges of concrete slab minimum of **2 in (50 mm)** to demonstrate continuity.
  5. Cut vapor retarder membrane carefully around penetrations and seal with either premolded accessories, or on-site collar fabrications using seaming tape or mastic; if field fabricated, comply with manufacturer's recommended details.
  6. Repair rips, tears, or punctures with seaming tape, or by cutting out damaged areas and patching with new vapor retarder membrane, overlapping damaged area minimum **6 in**

(150 mm) in each direction and apply seaming tape.

### **3.5 FIELD QUALITY CONTROL**

- A. **Manufacturer's Field Service:** Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
  - 1. **Manufacturer's Technical Representative Qualifications:** Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. **Inspection of In-Progress Work:** Owner may employ and pay a qualified independent inspection agency to perform the following inspections for field quality control. Re-inspections of materials failing to meet specified requirements shall be done at Contractor's expense.
  - 1. Prior to beginning concrete slab reinforcing installation, inspect vapor retarder membrane for rips, tears, and punctures.
  - 2. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed vapor retarder membrane removed from work area.
  - 3. Immediately prior to concrete placement work, inspect vapor retarder membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
  - 4. Continuously inspect concrete placement work, watching for damage to vapor retarder membrane.
  - 5. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.

### **3.6 PROTECTION**

- A. **Protection during Concrete Work:** Ensure vapor retarder membrane will be without damage or deterioration during in-place fabrication of concrete slab reinforcing and subsequent placement of concrete.
  - 1. Prevent vehicles from driving over vapor retarder membrane once it has been placed.
  - 2. Prevent wood or steel stakes from penetrating vapor retarder membrane.
  - 3. At locations where portions of slab are not placed (block-outs, voids and leave-outs), provide protection to prevent water infiltration into void that would contaminate subgrade below vapor retarder membrane; maintain until concrete is subsequently placed.

END OF SECTION

## SECTION 22 05 17

### SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### PART 2 - PRODUCTS

##### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## **2.2 STACK-SLEEVE FITTINGS**

- A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## **2.3 SLEEVE-SEAL SYSTEMS**

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## **2.4 SLEEVE-SEAL FITTINGS**

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## **2.5 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 "Penetration Firestopping."

### **3.2 STACK-SLEEVE-FITTING INSTALLATION**

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 "Sheet Metal Flashing and Trim."
  3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 "Penetration Firestopping."

### **3.3 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.



### **3.4 SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### **3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Galvanized-steel wall sleeves
  - 2. Exterior Concrete Walls below Grade:
    - a. Galvanized-steel-pipe sleeves with sleeve-seal system
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Galvanized-steel wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Galvanized-steel-pipe sleeves.
  - 5. Interior Partitions:
    - a. Galvanized-steel-sheet sleeves.

END OF SECTION

## SECTION 22 05 18

### ESCUTCHEONS FOR PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### PART 2 - PRODUCTS

##### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plate finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

##### 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass finish.
    - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
    - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
    - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
    - g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
    - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
    - i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
    - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

### **3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

## SECTION 22 11 16

### DOMESTIC WATER PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Galvanized steel pipe and fittings.
4. Stainless-steel piping
5. CPVC piping.
6. PVC pipe and fittings.
7. PP pipe and fittings.
8. Piping joining materials.
9. Encasement for piping.
10. Transition fittings.
11. Dielectric fittings.

- B. Related Requirements:

1. Division 22 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

##### 1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner's representative no fewer than five days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. The product descriptions listed in the section may not all be used on this project. Refer to the Piping Material Schedules on the drawings for the specific application for each product or material. Products not shown on the schedule for the specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedule and specifications, the drawing schedule shall take precedent.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF Standard 372 for low lead.

### **2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  1. MSS SP-123.
  2. Cast-copper-alloy, hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal seating surfaces.
  4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
  1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  2. Fittings for NPS 2-1/2 to NPS 4 Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- H. Copper Push-on-Joint Fittings:
  1. Description:
    - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
    - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

- I. Copper-Tube, Extruded-Tee Connections:
  - 1. Description: Tee formed in copper tube according to ASTM F 2014.
  
- J. Appurtenances for Grooved-End Copper Tubing:
  - 1. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
  - 2. Mechanical Couplings for Grooved-End Copper Tubing:
    - a. Copper-tube dimensions and design similar to AWWA C606.
    - b. Ferrous housing sections.
    - c. EPDM-rubber gaskets suitable for hot and cold water.
    - d. Bolts and nuts.
    - e. Minimum Pressure Rating: 300 psig.

## 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
  - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
  
- B. Standard-Pattern, Mechanical-Joint Fittings:
  - 1. AWWA C110/A21.10, ductile or gray iron.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
  
- C. Compact-Pattern, Mechanical-Joint Fittings:
  - 1. AWWA C153/A21.53, ductile iron.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
  
- D. Push-on-Joint, Ductile-Iron Pipe:
  - 1. AWWA C151/A21.51.
  - 2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  
- E. Standard-Pattern, Push-on-Joint Fittings:
  - 1. AWWA C110/A21.10, ductile or gray iron.
  - 2. Gaskets: AWWA C111/A21.11, rubber.
  
- F. Compact-Pattern, Push-on-Joint Fittings:
  - 1. AWWA C153/A21.53, ductile iron.
  - 2. Gaskets: AWWA C111/A21.11, rubber.
  
- G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.
  
- H. Appurtenances for Grooved-End, Ductile-Iron Pipe:

1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
  - a. AWWA C606 for ductile-iron-pipe dimensions.
  - b. Ferrous housing sections.
  - c. EPDM-rubber gaskets suitable for hot and cold water.
  - d. Bolts and nuts.
  - e. Minimum Pressure Rating:
    - 1) NPS 14 to NPS 18: 250 psig.
    - 2) NPS 20 to NPS 46: 150 psig.

## 2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe:
  1. ASTM A 53/A 53M, Type E, Standard Weight.
  2. Include ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions:
  1. ASME B16.39, Class 150.
  2. Hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal, bronze seating surface.
  4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
  1. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  2. Fittings for Grooved-End, Galvanized-Steel Pipe:
    - a. AWWA C606 for steel-pipe dimensions.
    - b. Ferrous housing sections.
    - c. EPDM-rubber gaskets suitable for hot and cold water.
    - d. Bolts and nuts.
    - e. Minimum Pressure Rating:
      - 1) NPS 8 and Smaller: 600 psig.
      - 2) NPS 10 and NPS 12: 400 psig.
      - 3) NPS 14 to NPS 24: 250 psig..

## 2.5 STAINLESS-STEEL PIPING

- A. Potable-water piping and components shall comply with NSF 61 Annex G.



- B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 40.
- C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.
- D. Appurtenances for Grooved-End, Stainless-Steel Pipe:
  - 1. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
  - 2. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:
    - a. AWWA C606 for stainless-steel-pipe dimensions.
    - b. Stainless-steel housing sections.
    - c. Stainless-steel bolts and nuts.
    - d. EPDM-rubber gaskets suitable for hot and cold water.
    - e. Minimum Pressure Rating:
      - 1) NPS 8 and Smaller: 600 psig.
      - 2) NPS 10 and NPS 12 : 400 psig.
      - 3) NPS 14 to NPS 24: 250 psig.

## 2.6 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
  - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
  - 2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.
- D. Fittings: ASTM F 1807, metal insert and copper crimp rings ASTM F 1960, cold expansion fittings and reinforcing rings.
- E. Fittings: ASSE 1061, push-fit fittings.
- F. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

## 2.7 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
- B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.
- C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

## 2.8 PP PIPE AND FITTINGS

- A. PP Pipe: ASTM F 2389, SDR 7.4 and SDR 11.
- B. PVC Socket Fittings: ASTM F 2389.

## **2.9 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## **2.10 ENCASEMENT FOR PIPING**

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: tube.
- C. Color: Black or natural.

## **2.11 TRANSITION FITTINGS**

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
- D. Plastic-to-Metal Transition Fittings:
  - 1. Description:
    - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

- E. Plastic-to-Metal Transition Unions:
  - 1. Description:
    - a. CPVC or PVC four-part union.
    - b. Brass or stainless-steel threaded end.
    - c. Solvent-cement-joint or threaded plastic end.
    - d. Rubber O-ring.
    - e. Union nut.

## 2.12 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Standard: ASSE 1079.
  - 2. Pressure Rating: 250 psig.
  - 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Standard: ASSE 1079.
  - 2. Factory-fabricated, bolted, companion-flange assembly.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F 300 psig.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Nonconducting materials for field assembly of companion flanges.
  - 2. Pressure Rating: 150 psig.
  - 3. Gasket: Neoprene or phenolic.
  - 4. Bolt Sleeves: Phenolic or polyethylene.
  - 5. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
  - 1. Standard: IAPMO PS 66.
  - 2. Electroplated steel nipple complying with ASTM F 1545.
  - 3. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 4. End Connections: Male threaded or grooved.
  - 5. Lining: Inert and noncorrosive, propylene.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and

calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 "Domestic Water Piping Specialties."
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."

- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 "Domestic Water Pumps."
- U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

- J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D 2855.
- N. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.4 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### **3.5 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits or nipples.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for seismic-restraint devices in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- B. Comply with requirements for pipe hanger, support products, and installation in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  - 7. NPS 6: 12 feet with 3/4-inch rod.
  - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  - 7. NPS 6 :12 feet with 3/4-inch rod.

- 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- J. Install supports for vertical stainless-steel piping every 15 feet.
- K. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
  - 3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 5. NPS 6: 48 inches with 3/4-inch rod.
  - 6. NPS 8: 48 inches with 7/8-inch rod.
- L. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
  - 2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
  - 5. NPS 8: 48 inches with 7/8-inch rod.
- N. Install supports for vertical PVC piping every 48 inches.
- O. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
  - 3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 5. NPS 6: 48 inches with 3/4-inch rod.
  - 6. NPS 8: 48 inches with 7/8-inch rod.
- P. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- Q. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.



- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### **3.8 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
  - C. Prepare test and inspection reports.

### **3.10 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.11 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

- d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.12 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

### **3.13 VALVE SCHEDULE**

- A. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

## SECTION 22 11 19

### DOMESTIC WATER PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water-hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
18. Specialty valves.
19. Flexible connectors.
20. Water meters.

- B. Related Requirements:

1. Division 22 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 "Domestic Water Piping" for water meters.
3. Division 22 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Division 22 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Division 22 "Emergency Plumbing Fixtures" for water tempering equipment.

### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
  - 1. Include diagrams for power, signal, and control wiring.

### **1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.
- B. The product descriptions listed in the section may not all be used on this project. Refer to the Product Schedules and details on the drawings for the specific application for each product or material. Products shown on the schedule for a specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedule and specifications, the drawing schedule shall take precedent.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

### **2.3 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Standard: ASSE 1001.
  - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: Threaded.
  - 5. Finish: Chrome plated.
- B. Pressure Vacuum Breakers:
  - 1. Standard: ASSE 1020.
  - 2. Operation: Continuous-pressure applications.
  - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
  - 4. Pressure Loss at Design Flow Rate: 5 psi max.
  - 5. Accessories:

- a. Valves: Ball type, on inlet and outlet.

## 2.4 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
  - 1. Standard: ASSE 1003.
  - 2. Pressure Rating: Initial working pressure of 150 psig.
  - 3. Design Flow Rate: See Drawings.
  - 4. Design Inlet Pressure: See Drawings.
  - 5. Design Outlet Pressure Setting: See Drawings.
  - 6. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
  - 7. Valves for Booster Heater Water Supply: Include integral bypass.
  - 8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.
  
- B. Water-Control Valves:
  - 1. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
  - 2. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
  - 3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
    - a. Pattern: Angle or Globe-valve design.
    - b. Trim: Stainless steel.
  - 4. Design Flow: See Drawings.
  - 5. Design Inlet Pressure: See Drawings.
  - 6. Design Outlet Pressure Setting: See Drawings.
  - 7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

## 2.5 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
  - 1. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
  - 2. Body: Brass or bronze.
  - 3. Size: Same as connected piping, but not larger than NPS 2.
  - 4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
  
- B. Cast-Iron Calibrated Balancing Valves:
  - 1. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
  - 2. Size: Same as connected piping, but not smaller than NPS 2-1/2.
  
- C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
  
- D. Memory-Stop Balancing Valves:
  - 1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  - 2. Pressure Rating: 400-psig minimum CWP.
  - 3. Size: NPS 2 or smaller.
  - 4. Body: Copper alloy.
  - 5. Port: Standard or full port.
  - 6. Ball: Chrome-plated brass.
  - 7. Seats and Seals: Replaceable.

8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

## 2.6 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch.
  - b. Strainers NPS 2-1/2 to NPS 4 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve.

## 2.7 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS ¾.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS ¾.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS ¾ threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS ¾.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

## 2.8 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
  - 1. Body: Bronze.
  - 2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
  - 3. Float: Replaceable, corrosion-resistant metal.
  - 4. Mechanism and Seat: Stainless steel.
  - 5. Size: NPS 1/2 minimum inlet.
  - 6. Inlet and Vent Outlet End Connections: Threaded.
  
- B. Welded-Construction Automatic Air Vents:
  - 1. Body: Stainless steel.
  - 2. Pressure Rating: 150-psig minimum pressure rating.
  - 3. Float: Replaceable, corrosion-resistant metal.
  - 4. Mechanism and Seat: Stainless steel.
  - 5. Size: NPS 3/8 minimum inlet.
  - 6. Inlet and Vent Outlet End Connections: Threaded.

## 2.9 SPECIALTY VALVES

- A. Comply with requirements for general-duty metal valves in Division 22 "Ball Valves for Plumbing Piping," "Butterfly Valves for Plumbing Piping," "Check Valves for Plumbing Piping," and "Gate Valves for Plumbing Piping."
  
- B. CPVC Union Ball Valves:
  - 1. Description:
    - a. Standard: MSS SP-122.
    - b. Pressure Rating and Temperature: 150 psig 73 deg F.
    - c. Body Material: CPVC.
    - d. Body Design: Union type.
    - e. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
    - f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
    - g. Ball: CPVC; full port.
    - h. Seals: PTFE or EPDM-rubber O-rings.
    - i. Handle: Tee shaped.
  
- C. PVC Union Ball Valves:
  - 1. Description:
    - a. Standard: MSS SP-122.
    - b. Pressure Rating and Temperature: 150 psig 73 deg F.
    - c. Body Material: PVC.
    - d. Body Design: Union type.
    - e. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
    - f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
    - g. Ball: PVC; full port.
    - h. Seals: PTFE or EPDM-rubber O-rings.
    - i. Handle: Tee shaped.
  
- D. CPVC Non-union Ball Valves:
  - 1. Description:



- a. Standard: MSS SP-122.
  - b. Pressure Rating and Temperature: 150 psig 73 deg F.
  - c. Body Material: CPVC.
  - d. Body Design: Non-union type.
  - e. End Connections: Socket or threaded.
  - f. Ball: CPVC; full or reduced port.
  - g. Seals: PTFE or EPDM-rubber O-rings.
  - h. Handle: Tee shaped.
- E. PVC Non-union Ball Valves:
- 1. Description:
    - a. Standard: MSS SP-122.
    - b. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - c. Body Material: PVC.
    - d. Body Design: Non-union type.
    - e. End Connections: Socket or threaded.
    - f. Ball: PVC; full or reduced port.
    - g. Seals: PTFE or EPDM-rubber O-rings.
    - h. Handle: Tee shaped.
- F. CPVC Butterfly Valves:
- 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - b. Body Material: CPVC.
    - c. Body Design: Lug or wafer type.
    - d. Seat: EPDM rubber.
    - e. Seals: PTFE or EPDM-rubber O-rings.
    - f. Disc: CPVC.
    - g. Stem: Stainless steel.
    - h. Handle: Lever.
- G. PVC Butterfly Valves:
- 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F Insert temperature.
    - b. Body Material: PVC.
    - c. Body Design: Lug or wafer type.
    - d. Seat: EPDM rubber.
    - e. Seals: PTFE or EPDM-rubber O-rings.
    - f. Disc: PVC.
    - g. Stem: Stainless steel.
    - h. Handle: Lever.
- H. CPVC Ball Check Valves:
- 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - b. Body Material: CPVC.
    - c. Body Design: Union-type ball check.
    - d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
    - e. End Connections for Valves NPS 2-1/2 to NPS 4 Detachable, socket or threaded.
    - f. Ball: CPVC.
    - g. Seals: EPDM- or FKM-rubber O-rings.

- I. PVC Ball Check Valves:
  - 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - b. Body Material: PVC.
    - c. Body Design: Union-type ball check.
    - d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
    - e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
    - f. Ball: PVC.
    - g. Seals: EPDM- or FKM-rubber O-rings.
  
- J. CPVC Gate Valves:
  - 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - b. Body Material: CPVC.
    - c. Body Design: Nonrising stem.
    - d. End Connections for Valves NPS 2 and Smaller: socket or threaded.
    - e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or threaded.
    - f. Gate and Stem: Plastic.
    - g. Seals: EPDM rubber.
    - h. Handle: Wheel.
  
- K. PVC Gate Valves:
  - 1. Description:
    - a. Pressure Rating and Temperature: 150 psig at 73 deg F.
    - b. Body Material: PVC.
    - c. Body Design: Nonrising stem.
    - d. End Connections for Valves NPS 2 and Smaller: Socket or threaded.
    - e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or threaded.
    - f. Gate and Stem: Plastic.
    - g. Seals: EPDM rubber.
    - h. Handle: Wheel.

## 2.10 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: Minimum 250 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
  
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  - 1. Working-Pressure Rating: Minimum 250 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## 2.11 WATER METERS

- A. Displacement-Type Water Meters:
  - 1. Description:
    - a. Standard: AWWA C700.
    - b. Pressure Rating: 150-psig working pressure.
    - c. Body Design: Nutating disc; totalization meter.
    - d. Registration: In gallons or cubic feet as required by utility company.
    - e. Case: Bronze.
    - f. End Connections: Threaded.
- B. Turbine-Type Water Meters:
  - 1. Description:
    - a. Standard: AWWA C701.
    - b. Pressure Rating: 150-psig working pressure.
    - c. Body Design: Turbine; totalization meter.
    - d. Registration: In gallons or cubic feet as required by utility company.
    - e. Case: Bronze.
    - f. End Connections for Meters NPS 2 and Smaller: Threaded.
    - g. End Connections for Meters NPS 2-1/2 and Larger: Flanged.
- C. Compound-Type Water Meters:
  - 1. Description:
    - a. Standard: AWWA C702.
    - b. Pressure Rating: 150-psig working pressure.
    - c. Body Design: With integral mainline and bypass meters; totalization meter.
    - d. Registration: In gallons or cubic feet as required by utility company.
    - e. Case: Bronze.
    - f. Pipe Connections: Flanged.
- D. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
- E. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe

- diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
  - C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
  - D. Install balancing valves in locations where they can easily be adjusted.
  - E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
    1. Install cabinet-type units recessed in or surface mounted on wall as specified.
  - F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
  - G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06 "Rough Carpentry."
  - H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
    1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06 "Rough Carpentry."
  - I. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
  - J. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
  - K. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.
  - L. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.
  - M. Install water-hammer arresters in water piping according to PDI-WH 201.
  - N. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
  - O. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
  - P. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
  - Q. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### **3.2 CONNECTIONS**

- A. Comply with requirements for ground equipment in Division 26 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Division 26 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

### **3.3 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Pressure vacuum breakers.
  - 2. Intermediate atmospheric-vent backflow preventers.
  - 3. Reduced-pressure-principle backflow preventers.
  - 4. Double-check, backflow-prevention assemblies.
  - 5. Carbonated-beverage-machine backflow preventers.
  - 6. Dual-check-valve backflow preventers.
  - 7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
  - 8. Double-check, detector-assembly backflow preventers.
  - 9. Water pressure-reducing valves.
  - 10. Calibrated balancing valves.
  - 11. Primary, thermostatic, water mixing valves.
  - 12. Manifold, thermostatic, water mixing-valve assemblies.
  - 13. Photographic-process, thermostatic, water mixing-valve assemblies.
  - 14. Primary water tempering valves.
  - 15. Outlet boxes.
  - 16. Hose stations.
  - 17. Supply-type, trap-seal primer valves.
  - 18. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 "Identification for Plumbing Piping and Equipment."

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Test each pressure vacuum breaker and backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.5 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.

- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

## SECTION 22 13 16

### SANITARY WASTE AND VENT PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Related Requirements:
  - 1. Division 22 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
  - 2. Division 22 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
  - 3. Division 22 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

## **1.5 FIELD CONDITIONS**

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner's Representative no fewer than 5 days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
  - 2. Waste, Force-Main Piping: 100 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

### **2.2 PIPING MATERIALS**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. The product descriptions listed in the section may not all be used on this project. Refer to the Piping Material Schedules on the drawings for the specific application for each product or material. Products not shown on the schedule for the specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedule and specifications, the drawing schedule shall take precedent.

### **2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### **2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:



1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM C 1277.
2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.5 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

1. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
2. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

## 2.6 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

## 2.7 DUCTILE-IRON PIPE AND FITTINGS

- A. Ductile-Iron, Mechanical-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
  - 2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  - 3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Ductile-Iron, Push-on-Joint Piping:
  - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
  - 2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  - 3. Gaskets: AWWA C111/A21.11, rubber.
- C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.
- D. Ductile-Iron, Grooved-End Pipe Appurtenances:
  - 1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
  - 2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

## 2.8 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Copper Pressure Fittings:
  - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## **2.9 ABS PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
- D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- E. Solvent Cement: ASTM D 2235.

## **2.10 PVC PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
- F. Solvent Cement: ASTM D 2564.

## **2.11 SPECIALTY PIPE FITTINGS**

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 2. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:
  - a. Standard: ASTM C 1460.
  - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - c. End Connections: Same size as and compatible with pipes to be joined.
4. Pressure Transition Couplings:
  - a. Standard: AWWA C219.
  - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
  - c. Center-Sleeve Material: Manufacturer's Standard.
  - d. Gasket Material: Natural or synthetic rubber.
  - e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 125 psig minimum at 180 deg F.
    - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
2. Dielectric Flanges:
  - a.
  - b. Description:
    - 1) Standard: ASSE 1079.
    - 2) Factory-fabricated, bolted, companion-flange assembly.
    - 3) Pressure Rating: 125 psig minimum at 180 deg F.
    - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
3. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
4. Dielectric Nipples:
  - a. Description:
    - 1) Standard: IAPMO PS 66.
    - 2) Electroplated steel nipple.

- 3) Pressure Rating: 300 psig at 225 deg F.
- 4) End Connections: Male threaded or grooved.
- 5) Lining: Inert and noncorrosive, propylene.

## **2.12 ENCASEMENT FOR UNDERGROUND METAL PIPING**

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: tube.
- D. Color: Black or natural.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- L. Lay buried building waste piping beginning at low point of each system.
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install steel piping according to applicable plumbing code.
- P. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
- Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- R. Install aboveground ABS piping according to ASTM D 2661.
- S. Install aboveground PVC piping according to ASTM D 2665.
- T. Install underground ABS and PVC piping according to ASTM D 2321.
- U. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
  3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- V. Install underground, ductile-iron, force-main piping according to AWWA C600.
1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
  2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- W. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- X. Install force mains at elevations indicated.
- Y. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.
    - a. Comply with requirements for backwater valves specified in Division 22 "Sanitary Waste Piping Specialties."
  2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    - b. Comply with requirements for cleanouts specified in Division 22 "Sanitary Waste Piping Specialties."
  3. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Division 22 "Sanitary Waste Piping Specialties."
- Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- AA. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- BB. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Division 22 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
  - 1. Cut threads full and clean using sharp dies.
  - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    - c. Do not use pipe sections that have cracked or open welds.
- E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
  - 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.



b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric flange kits or nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.5 VALVE INSTALLATION

A. Comply with requirements in Division 22 "Ball Valves for Plumbing Piping," "Butterfly Valves for Plumbing Piping," "Check Valves for Plumbing Piping," and "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Division 22 "Sanitary Waste Piping Specialties."

### 3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
  - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
  8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2: 84 inches with 3/8-inch rod.
  2. NPS 3: 96 inches with 1/2-inch rod.
  3. NPS 4: 108 inches with 1/2-inch rod.
  4. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical stainless-steel piping every 10 feet.
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
  5. NPS 6: 10 feet with 5/8-inch rod.

- 6. NPS 8: 10 feet with 3/4-inch rod.
- M. Install supports for vertical copper tubing every 10 feet.
- N. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- O. Install supports for vertical ABS and PVC piping every 48 inches.
- P. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Install horizontal backwater valves in pit with pit cover flush with floor.
  - 6. Comply with requirements for backwater valves, cleanouts, and drains specified in Division 22 "Sanitary Waste Piping Specialties."
  - 7. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
  - 1. Sanitary Sewer: To exterior force main.
  - 2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### **3.8 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Division 22 "Identification for Plumbing Piping and Equipment."

### **3.9 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

- a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
  - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
  - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
  - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
    - a. Isolate test source and allow to stand for four hours.
    - b. Leaks and loss in test pressure constitute defects that must be repaired.
  3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  4. Prepare reports for tests and required corrective action.

### **3.10 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

END OF SECTION

## SECTION 22 13 19

### SANITARY WASTE PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Air-admittance valves.
4. Roof flashing assemblies.
5. Through-penetration firestop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. FOG disposal systems.

- B. Related Requirements:

1. Division 22 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Division 33 "Storm Utility Drainage Piping" for storm drainage piping and piping specialties outside the building.

##### 1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. FOG: Fats, oils, and greases.
- C. PVC: Polyvinyl chloride.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, and accessories for the following:
  1. FOG disposal systems.
- B. Shop Drawings:
  1. Show fabrication and installation details for frost-resistant vent terminals.
  2. Wiring Diagrams: Power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For FOG disposal systems, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Cultures: Provide 1-gal. bottles of bacteria culture recommended by manufacturer of FOG disposal systems equal to 200 percent of amount installed, but no fewer than two 1-gal. bottles.

## PART 2 - PRODUCTS

**2.1 The product descriptions listed in the section may not all be used on this project. Refer to the Equipment Schedules and details on the drawings for the specific application for each product or material. Products not shown on the schedule or details for the specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedule and specifications, the drawing schedule shall take precedent.**

## 2.2 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

## 2.3 BACKWATER VALVES

### A. Horizontal, Cast-Iron Backwater Valves:

1. Standard: ASME A112.14.1.
2. Size: Same as connected piping.
3. Body: Cast iron.
4. Cover: Cast iron with bolted or threaded access check valve.
5. End Connections: Hub and spigot or hubless.
6. Type Check Valve: Removable, bronze, swing check, factory assembled, or field modified to hang open for airflow unless subject to backflow condition.
7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

### B. Drain-Outlet Backwater Valves:

1. Size: Same as floor drain outlet.
2. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
3. Check Valve: Removable ball float.
4. Inlet: Threaded.
5. Outlet: Threaded or spigot.

### C. Horizontal, Plastic Backwater Valves:

1. Size: Same as connected piping.
2. Body: ABS or PVC.
3. Cover: Same material as body with threaded access to check valve.
4. Check Valve: Removable swing check.
5. End Connections: Socket type.

## 2.4 CLEANOUTS

### A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping per the piping schedules on drawings.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

### B. Stainless-Steel Exposed Cleanouts:

1. Standard: ASME A112.3.1.
2. Size: Same as connected drainage piping
3. Body Material: Stainless-steel tee with side cleanout as required to match connected piping.
4. Closure: Stainless-steel plug with seal.

### C. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M heavy-duty, adjustable housing, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Body or Ferrule: Cast iron.



4. Clamping Device: Required.
5. Outlet Connection: Same type as pipe.
6. Closure: Brass plug.
7. Adjustable Housing Material: Cast iron with threads, setscrews or other device.
8. Frame and Cover Material and Finish: Polished bronze material and finish.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Extra Heavy Duty.
11. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

D. Stainless-Steel Exposed Floor Cleanouts:

1. Standard: ASME A112.3.1.
2. Size: Same as connected branch.
3. Housing: Stainless steel.
4. Closure: Stainless steel with seal.
5. Riser: ASTM A 74, Extra-Heavy stainless-steel drainage pipe fitting and riser to cleanout.
6. Body or Ferrule: Stainless steel.
7. Clamping Device: Required.
8. Outlet Connection: Same as pipe.
9. Closure: Brass plug.
10. Adjustable Housing Material: Cast iron with threads, setscrews or other device.
11. Frame and Cover Material and Finish: Polished bronze.
12. Frame and Cover Shape: Round.
13. Top Loading Classification: Extra Heavy Duty.

E. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:
  - a. Brass.
  - b. Countersunk or raised head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, stainless-steel cover plate with screw.

F. Plastic Floor Cleanouts:

1. Size: Same as connected branch.
2. Body: PVC.
3. Closure Plug: PVC.
4. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

## 2.5 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
2. Housing: Plastic.

3. Operation: Mechanical sealing diaphragm.
4. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Standard: ASSE 1050 for vent stacks.
2. Housing: Plastic.
3. Operation: Mechanical sealing diaphragm.
4. Size: Same as connected stack vent or vent stack.

C. Wall Box for Air-Admittance Valves:

1. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
2. Size: Approximately 9 inches wide by 8 inches high by 4 inches deep.

## 2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

- a. Low-Silhouette Vent Cap: With vandal-proof vent cap.

## 2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
4. Stack Fitting for plastic stacks: ASTM A 48/A 48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating for corrosion-resistant plastic stacks: Corrosion resistant on interior of fittings.

## 2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

## **2.9 FOG DISPOSAL SYSTEMS**

### **A. FOG Disposal Systems:**

1. Standard: ASME A112.14.6, for removing solids from and breaking down and digesting suspended fats, oils, and greases from food-preparation or processing wastewater.
2. Flow-Control Fitting: Matching unit size.
3. Strainer Unit: Stainless-steel housing with aluminum cover and removable-basket-type, stainless-steel, wire-mesh strainer. Include pressure plug instead of cover. Include extra basket. Include stainless-steel extension.
4. Media Chamber: Stainless-steel housing and aluminum cover, with internal baffles, piping, plastic coalescing surfaces, and clarifier section with test ports. Include stainless-steel extension.
5. Shelf: Stainless steel, 19-1/2 inches wide by 13 inches high by 8-3/4 inches deep, for metering pump, control devices, and culture bottle.
6. Culture Metering Pump, Timer, Control, and Tubing: Proprietary.
7. Culture: Include 1-gal. bottle, as recommended by unit manufacturer.
8. Piping: Waste and vent piping is specified in Division 22 "Sanitary Waste and Vent Piping."

## **2.10 MOTORS**

### **A. General requirements for motors are specified in Division 22 "Common Motor Requirements for Plumbing Equipment."**

1. Motor Sizes: Minimum size as indicated. If not indicated, motor shall be large enough, so driven load will not require motor to operate in service factor range above 1.0.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

#### **A. Equipment Mounting:**

1. Install FOG disposal systems on cast-in-place concrete equipment base(s).
  - a. Comply with requirements for equipment bases and foundations specified in Division 33 "Cast-in-Place Concrete."
2. Comply with requirements for vibration-isolation and seismic-control devices specified in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
3. Comply with requirements for vibration-isolation devices specified in Division 22 "Vibration Controls for Plumbing Piping and Equipment."

#### **B. Install backwater valves in building drain piping.**

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Division 07 "Sheet Metal Flashing and Trim."
- G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
  - 1. Comply with requirements in Division 07 "Penetration Firestopping."
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- Q. Assemble components of FOG disposal systems and install on floor.
  - 1. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction.

2. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated.
  3. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.
- R. Install wood-blocking reinforcement for wall-mounting-type specialties.
- S. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Division 22 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. FOG Disposal Systems: Connect inlet and outlet to unit, connect flow-control fitting and fresh-air inlet piping to unit inlet piping, and connect vent piping between trap and media chamber. Connect electrical power.
- D. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FLASHING INSTALLATION**

- A. Comply with requirements in Division 07 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### **3.4 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. FOG disposal systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
  - 1. Nameplates and signs are specified in Division 07 "Identification for Plumbing Piping and Equipment."

### **3.5 FIELD QUALITY CONTROL**

- A. Perform tests and inspections, and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.6 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

### **3.7 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems. Refer to Division 01 "Demonstration and Training."

END OF SECTION

## SECTION 22 14 13

### FACILITY STORM DRAINAGE PIPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Related Sections:
  - 1. Division 22 "Sump Pumps" for storm drainage pumps.
  - 2. Division 33 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

##### 1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.
  - 2. Storm Drainage, Force-Main Piping: 100 psig.
- B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For controlled-flow or siphonic roof drainage system. Include calculations, plans, and details.

##### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.



1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

## **1.6 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

## **1.7 PROJECT CONDITIONS**

- A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  1. Notify Owner' Representative no fewer than five days in advance of proposed interruption of storm-drainage service.
  2. Do not proceed with interruption of storm-drainage service without Owner Representative's written permission.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. The product descriptions listed in the section may not all be used on this project. Refer to the Piping Material Schedules on the drawings for the specific application for each product or material. Products not shown on the schedule for the specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedule and specifications, the drawing schedule shall take precedent.

### **2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
  2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
1. Standards: ASTM C 1277 and ASTM C 1540.
  2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Cast-Iron, Hubless-Piping Couplings:
1. Standard: ASTM C 1277.
  2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## **2.4 GALVANIZED-STEEL PIPE AND FITTINGS**

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight. Include square-cut-grooved or threaded ends matching joining method.
- B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12 threaded.
- C. Steel-Pipe Pressure Fittings:
1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Cast-Iron Flanges: ASME B16.1, Class 125.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:
1. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged-steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
  2. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

## **2.5 DUCTILE-IRON PIPE AND FITTINGS**

- A. Ductile-Iron, Mechanical-Joint Piping:
1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.

3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Ductile-Iron, Push-On-Joint Piping:
1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  3. Gaskets: AWWA C111/A21.11, rubber.
- C. Ductile-Iron, Grooved-Joint Piping:
1. Ductile-Iron Pipe: AWWA C151/A21.51 with round-cut-grooved ends according to AWWA C606.
  2. Ductile-Iron-Pipe Appurtenances:
    - a. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings with dimensions matching AWWA C110/A21.10 ductile-iron pipe or AWWA C153/A21.53 ductile-iron fittings and complying with AWWA C606 for grooved ends.
    - b. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

## 2.6 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Copper Pressure Fittings:
1. Copper Fittings: ASME B16.18, cast-copper-alloy fittings or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.7 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

- B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
- C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- D. Solvent Cement: ASTM D 2235.

## **2.8 PVC PIPE AND FITTINGS**

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

## **2.9 SPECIALTY PIPE FITTINGS**

- A. Transition Couplings:
  1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
  2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  3. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  4. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  5. Pressure Transition Couplings:
    - a. Standard: AWWA C219.
    - b. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
    - c. Center-Sleeve Material: To match pipe type.
    - d. Gasket Material: Natural or synthetic rubber.
    - e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 150 psig at 180 deg F (82 deg C).
    - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
  - a.
  - b. Description:
    - 1) Standard: ASSE 1079.
    - 2) Factory-fabricated, bolted, companion-flange assembly.
    - 3) Pressure Rating: 150 psig.
    - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel-backing washers.
5. Dielectric Nipples:
  - a. Description:
    - 1) Electroplated steel nipple complying with ASTM F 1545.
    - 2) Pressure Rating: 300 psig.
    - 3) End Connections: Male threaded or grooved.
    - 4) Lining: Inert and noncorrosive, propylene.

**2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING**

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: High-density, crosslaminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Install aboveground ABS piping according to ASTM D 2661.
- R. Install aboveground PVC piping according to ASTM D 2665.
- S. Install underground ABS and PVC piping according to ASTM D 2321.
- T. Install engineered controlled-flow and siphonic drain specialties and storm drainage piping in locations indicated.
- U. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- W. Install force mains at elevations indicated.
- X. Plumbing Specialties:
  - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 "Storm Drainage Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 "Storm Drainage Piping Specialties."
  - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 "Storm Drainage Piping Specialties."
- Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Z. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- AA. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- BB. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendices.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendices.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Drainage Piping: Shielded, nonpressure transition couplings.
  - 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force-Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
  - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.



2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 "Ball Valves for Plumbing Piping," "Check Valves for Plumbing Piping," and "Gate Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
  1. Install gate or full-port ball valve for piping NPS 2 and smaller.
  2. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  2. Install backwater valves in accessible locations.
  3. Comply with requirements for backwater valves specified in Division 22 "Storm Drainage Piping Specialties."

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  6. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
  8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  5. NPS 6: 10 feet with 5/8-inch rod.
  6. NPS 8: 10 feet with 3/4-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  2. NPS 3: 48 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.
  - 3. Comply with requirements for backwater valves, cleanouts, and drains specified in Division 22 "Storm Drainage Piping Specialties."
- D. Connect force-main piping to the following:
  - 1. Storm Sewer: To exterior force main.
  - 2. Sump Pumps: To sump pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### **3.8 IDENTIFICATION**

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 "Identification for Plumbing Piping and Equipment."

### **3.9 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  4. Prepare reports for tests and required corrective action.

### **3.10 CLEANING**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

## SECTION 22 14 23

### STORM DRAINAGE PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Roof drains.
  - 2. Miscellaneous storm drainage piping specialties.
  - 3. Cleanouts.
  - 4. Backwater valves.
  - 5. Trench drains.
  - 6. Channel drainage systems.
  - 7. Through-penetration firestop assemblies.
  - 8. Flashing materials.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

##### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

## **PART 2 - PRODUCTS**

**PART 3 - See "Writing Guide" Article in the Evaluations for a discussion of this Section's organization and the most efficient way to revise this Section.**

**3.1 The product descriptions listed in the section may not all be used on this project. Refer to the Equipment Schedules on the drawings for the specific application for each product or material. Products not shown on the schedule for the specific application may not be substituted without pre-approval from the Engineer. Where there is a conflict between the drawing schedules and specifications, the drawing schedules shall take precedent.**

### **3.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**

**A. Downspout Adaptors:**

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

**B. Downspout Boots:**

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

**C. Conductor Nozzles:**

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

**D. Test Tees:**

1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure Plug: Countersunk or raised head, brass.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

### **3.3 BACKWATER VALVES**

**A. Cast-Iron, Horizontal Backwater Valves:**

1. Standard: ASME A112.14.1, for backwater valves.
2. Size: Same as connected piping.
3. Body Material: Cast iron.
4. Cover: Cast iron with bolted or threaded access check valve.
5. End Connections: Match pipe type.
6. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.

7. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
- B. Cast-Iron, Drain-Outlet Backwater Valves:
1. Size: Same as floor drain outlet.
  2. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
  3. Check Valve: Removable ball float.
  4. Inlet: Threaded.
  5. Outlet: Threaded or spigot.
- C. Plastic, Horizontal Backwater Valves:
1. Standard: ASME A112.14.1, for backwater valves.
  2. Size: Same as connected piping.
  3. Body Material: ABS or PVC.
  4. Cover: Same material as body with threaded access to check valve.
  5. Check Valve: Removable swing check.
  6. End Connections: Socket type.

### **3.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES**

- A. Through-Penetration Firestop Assemblies:
1. Standard: ASTM E 814, for through-penetration firestop assemblies.
  2. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
  3. Size: Same as connected pipe.
  4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
  5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
  6. Special Coating: Corrosion resistant on interior of fittings.

### **3.5 FLASHING MATERIALS**

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.

## **PART 4 - EXECUTION**

### **4.1 INSTALLATION**

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Install expansion joints, if indicated, in roof drain outlets.
  - 3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.
- D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate cleanouts at base of each vertical soil and waste stack.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install horizontal backwater valves in floor with cover flush with floor.
- I. Install drain-outlet backwater valves in outlet of drains.
- J. Install test tees in vertical conductors and near floor.
- K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
- M. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- N. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- O. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.



## **4.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Division 22 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

## **4.3 FLASHING INSTALLATION**

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

## **4.4 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

## SECTION 22 23 11

### FACILITY NATURAL-GAS PIPING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.

##### 1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

##### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe: ASTM D 2513, SDR 11.
  - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  - 4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.

- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

## 2.2 PIPING SPECIALTIES

### A. Appliance Flexible Connectors:

- 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
- 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 4. Corrugated stainless-steel tubing with polymer coating.
- 5. Operating-Pressure Rating: 0.5 psig.
- 6. End Fittings: Zinc-coated steel.
- 7. Threaded Ends: Comply with ASME B1.20.1.
- 8. Maximum Length: 72 inches

### B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

- 1. Copper-alloy convenience outlet and matching plug connector.
- 2. Nitrile seals.
- 3. Hand operated with automatic shutoff when disconnected.
- 4. For indoor or outdoor applications.
- 5. Adjustable, retractable restraining cable.

### C. Y-Pattern Strainers:

- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
- 2. End Connections: Threaded ends for NPS 2 and smaller.
- 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- 4. CWP Rating: 125 psig.

### D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.3 JOINING MATERIALS

### A. Joint Compound and Tape: Suitable for natural gas.

### B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.4 MANUAL GAS SHUTOFF VALVES

### A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

### B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

- 1. CWP Rating: 125 psig.
- 2. Threaded Ends: Comply with ASME B1.20.1.

3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Kerotest Manufacturing Corp.
  - b. Lyall, R. W. & Company, Inc.
  - c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

G. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

## 2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.

4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Canadian Meter Company Inc.
  - b. Eaton Corporation; Controls Div.
  - c. Harper Wyman Co.
  - d. Maxitrol Company.
  - e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

## 2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Hart Industries International, Inc.
  - d. Jomar International Ltd.
  - e. Matco-Norca, Inc.
  - f. McDonald, A. Y. Mfg. Co.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - h. Wilkins; a Zurn company.
2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## 2.7 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## PART 3 - EXECUTION

### 3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 "Earth Moving" for excavating, trenching, and backfilling.
  1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
  1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 "Meters and Gages for HVAC Piping."



### 3.2 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.

- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 22 "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### **3.3 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

### **3.4 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  2. Cut threads full and clean using sharp dies.
  3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### **3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hangers and supports specified in Division 22 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

### **3.6 CONNECTIONS**

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### **3.7 LABELING AND IDENTIFYING**

- A. Comply with requirements in Division 22 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.8 FIELD QUALITY CONTROL**

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.9 PAINTING**

- A. Comply with requirements in Division 09 "Exterior Painting" and "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (flat).
    - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### **3.10 OUTDOOR PIPING SCHEDULE**

- A. Underground natural-gas piping shall be one of the following:
  - 1. See piping schedule on drawings.
  - 2. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
  - 3. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### **3.11 INDOOR PIPING SCHEDULE**

- A. See piping schedule on drawings.

### **3.12 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground: PE valves.

### **3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.

END OF SECTION

## GENERAL ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Requirements under Division 1 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 1, this section and division take precedence. Become thoroughly familiar with all their contents as to requirements that affect this division, section or both. The work required under this section includes material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate each system's functioning as implied by the design and the equipment specified.
- B. The specifications and drawings for the project are complementary, and portions of the work described in one, shall be provided as if described in both. In the event of discrepancies, notify the engineer and request clarification prior to proceeding with the work involved.
- C. Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of work, indicating the intended general arrangement of the equipment and other materials without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all contract documents. Correct errors that could have been avoided by proper checking and inspection, at no additional cost to the owner.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the contract is based.

#### 1.2 DEFINITIONS

- A. Whenever used in these specifications or drawings, the following terms shall have the indicated meanings:
  - 1. Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
  - 2. Install: "to perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
  - 3. Provide: "to furnish and install complete, and ready for the intended use."

4. Furnished by owner (or owner-furnished) or furnished by others: "an item furnished by the owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.
  5. Engineer: where referenced in this division, "engineer" is the engineer of record and the design professional for the work under this division, and is a consultant to, and an authorized representative of, the architect, as defined in the general and/or supplementary conditions. When used in this division, it means increased involvement by, and obligations to, the engineer, in addition to involvement by, and obligations to, the "architect".
  6. AHJ: the local code and/or inspection agency (authority) having jurisdiction over the work.
  7. NRTL: nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, certified, or all three, by an NRTL, and acceptable to the AHJ over this project.

### 1.3 PRE-BID SITE VISIT

- A. Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

### 1.4 MATERIAL AND WORKMANSHIP

- A. Provide all material and equipment new and in first class condition. Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. In general, provide the following quality grade(s) for all materials and equipment:
- B. Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the architect and engineer. Workmanship shall be the finest possible by experienced mechanics of the proper trade.
- C. The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal or excessive noise from equipment, devices or other system components will not be acceptable.
- D. Remove from the premises waste material present as a result of work. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.
- E. Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction.

## 1.5 MANUFACTURERS

- A. In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers listed are not in accordance with any ranking or preference.
- C. Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

## 1.6 COORDINATION

- A. Coordinate all work with other divisions and trades so that the various components of the systems will be installed at the proper time, fit the available space, and will allow proper service access to those items requiring maintenance. Refer to all other division's drawings, and to relevant equipment submittals and shop drawings to determine the extent of clear spaces. Components which are installed without regard to the above shall be relocated at no additional cost to the owner.
- B. Unless otherwise indicated, the general contractor will provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the general contractor with information where chases and openings are required. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing system components in the manner anticipated in the design. Keep informed as to the work of other trades engaged in the construction of the project, and execute work in a manner as to not interfere with or delay the work of other trades.
- C. Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor will be held responsible for errors that could have been avoided by proper checking and inspection.
- D. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the construction documents are not necessarily intended to designate the required trim.

## 1.7 ORDINANCES, CODES, AND STANDARDS

- A. Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ including any amendments and standards as set forth by the National Fire Protection Association (NFPA), Underwriters Laboratories (UL), Occupational Safety and Health Administration (OSHA), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), American Society of Testing Materials (ASTM) and other national standards and codes where applicable. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services.
- B. Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence.
- C. Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the engineer's attention for final resolution. Contractor will be



held responsible for any violation of the law.

- D. Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for and furnish certificates of inspection to owner. Contractor will be held responsible for violations of the law.

#### 1.8 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Store and protect from damage equipment and materials delivered to job site, in accordance with manufacturers' recommendations. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material that has been damaged by construction activities will be rejected, and contractor shall furnish new equipment and material as required at no additional cost to the owner.
- B. Keep premises broom clean from foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.
- C. Plug or cap open ends of conduits while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

#### 1.9 SUBSTITUTIONS

- A. Include in the base bid the products specifically named in these specifications or on the drawings. Submit, in the form of alternates, with bid, products of any other manufacturers for similar use, provided the differences in cost, if any, are included for each proposed alternate.
- B. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The proposer of any substitutions shall compensate the Engineer at a rate of \$150.00 per hour for time spent evaluating proposed substitutions and or the subsequent revisions to the design required to utilize the substitution.
- C. The Architect's or Engineer's decision to approve or disapprove a substitution in a Bid is final.
- D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.
- E. No substitutions will be considered after receipt of Bids and before award of the Contract.
- F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

#### 1.10 SUBMITTALS

- A. Assemble and submit to the architect, for engineer's review, manufacturers' product literature for

material and equipment to be furnished, installed, or both, under this division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this division. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Provide the number of submittals required by division 1; however, at a minimum, submit two (2) sets. Before submitting, verify that all materials and equipment submitted are mutually compatible and suitable for the intended use, fit the available spaces, and allow ample and code-required room for access and maintenance. Submittals shall contain the following information. Submittals not so identified will be returned to the contractor without action:

1. The project name.
  2. The applicable specification section and paragraph.
  3. The submittal date.
  4. The contractor's stamp, which shall certify that the stamped drawings have been checked by the contractor, comply with the drawings and specifications, and have been coordinated with other trades.
- B. Submittals and shop drawings shall not contain HP Engineering's firm name or logo, nor shall it contain the HP Engineering's engineers' seal and signature. They shall not be copies of HP Engineering's work product.
- C. Transmit submittals as early as required to support the project schedule. Allow for two weeks engineer review time, plus mailing time, plus a duplication of this time for re-submittals, if required. The engineer's submittal reviews will not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or for omitting components or fittings; or for not coordinating items with actual building conditions.
- D. Refer to division 1 for acceptance of electronic submittals for this project. For electronic submittals, contractor shall submit the documents in accordance with the procedures specified in division 1. Contractor shall notify the architect and engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in division 1, contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, contractor shall copy the architect and engineer's designated representatives. Contractor shall allow the engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

#### 1.11 ELECTRONIC DRAWING FILES

- A. In preparation of shop drawings or record drawings, contractor may, as an option, obtain electronic drawing files in Revit, AutoCAD, or DXF format from the engineer for a fee of \$300 for a drawing set up to 10 sheets plus \$25 per sheet in excess of 10 sheets. Contact the architect for written authorization; and, contact the engineer to obtain the necessary release agreement form and to indicate the desired shipping method and drawing format. In addition to payment, architect's written authorization and engineer's release agreement form must be received before electronic drawing files will be sent.

#### 1.12 OPERATION AND MAINTENANCE MANUALS

- A. Submit to the architect, for engineer's review, copies each of operations and maintenance

instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed. Paper clips, staples, rubber bands, and mailing envelopes are not considered approved binders. Provide the number of submittals required by Division 1; however, at a minimum, submit two (2) sets, and include, at a minimum, the following information:

1. Cover sheet that lists the project name, date, owner, architect, consulting engineer, general contractor, sub-contractor, and an index of contents.
  2. Manufacturers' catalogs and product data sheets
  3. Wiring diagrams
  4. Operation and Maintenance instructions
  5. Parts lists
  6. Approved shop drawings
  7. Test reports as defined in NETA ATS for the systems and equipment provided or furnished or installed under this contract.
  8. Names, addresses, telephone numbers, and e-mail addresses of local contacts for warranty services and spare parts.
- B. Submit manuals prior to requesting the final punch list and before any requests for substantial completion. Final approval of this division's systems installed under this contract will be withheld until this equipment brochure is received and deemed complete by the architect and engineer.
- C. Provide "as-built" drawings (see Division 1 and general conditions).

#### 1.13 TRAINING

- A. At a time mutually agreed upon between the owner and contractor, provide the services of a factory trained and authorized representative to train owner's designated personnel on the operation and maintenance of the equipment provided for this project.
- B. Provide training to include but not be limited to an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.
- C. Submit a certification letter to the architect stating that the owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The contractor and the owner's representative shall sign the certification letter indicating agreement that the training has been provided.
- D. Schedule training with owner with at least 7 days advance notice.

#### 1.14 WARRANTIES

- A. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of substantial completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's

standard warranty exceeds this duration. Warranties shall include labor and material. Remedy all defects, occurring within the warranty period(s), as stated in the general conditions and Division 1 without any additional costs to the owner.

- B. Perform any required remedial work promptly, upon written notice from the engineer or owner.
- C. At the time of substantial completion, deliver to the owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the required period, each warranty instrument being addressed to the owner and stating the commencement date and term.

#### 1.15 MISCELLANEOUS REMODELING WORK

- A. Provide all demolition of existing electrical systems and new electrical system modifications required because of building remodeling, as noted on the drawings, or necessary for proper operation and new construction. Remove all abandoned cables and wiring above accessible ceilings and ventilation shafts.

### PART 2 - ELECTRICAL WORK

#### 2.1 BUILDING OPERATION

- A. Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in continuous operation. Accomplish work that requires interruption of building operation at a time when the building is not in operation, and only with written approval of building owner and/or tenant. Coordinate interruption of building operation with the owner and/or tenant a minimum of 7 days in advance of work.

#### 2.2 EXCAVATION AND BACKFILLING

- A. Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of building without prior consultation with the architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6" layers of well-tamped dry earth in a manner to prevent future settlement.
- B. Excavation as herein specified shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Excavated materials which are considered unsuitable for backfill, and surplus of excavated material which is not required for backfill, shall be disposed of by the contractor at his own expense and responsibility, and to the satisfaction of the architect.

#### 2.3 COINCIDENTAL DAMAGE

- A. Repair all streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of this work. Repair materials shall match existing construction. All backfilling and repairing shall meet all requirements of the owner, city and others having jurisdiction. Repair work shall be thoroughly first class. Conform to all requirements of Division 2 of these specifications.

#### 2.4 CUTTING AND PATCHING

- A. Following the requirements in Division 1, cut walls, floors, ceilings, and other portions of the facility as required to perform work under this division. Obtain permission of the architect, owner, or both, before doing any cutting. Cut all holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. All patching shall be thoroughly first class and shall match the original material and construction, including fire ratings if applicable in a manner satisfactory to the architect.

## 2.5 ROUGH-IN

- A. Coordinate without delay all roughing-in with other divisions. Conceal all piping and rough-in except in unfinished areas and where otherwise indicated in the construction documents.

## 2.6 SUPPORT SYSTEMS

- A. Steel slotted support systems (slotted channel): comply with MFMA-3, factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.
- B. Finishes:
  - 1. Metallic coatings: hot-dip galvanized after fabrication and applied according to MFMA-3.
  - 2. Nonmetallic coatings: manufacturer's standard PVC, polyurethane or polyester coating applied according to MFMA-3.
  - 3. Painted coatings: manufacturer's standard painted coating applied according to MFMA-3
- C. Aluminum slotted support systems (slotted channel): comply with MFMA-3, type 6063-T6, per ASTM B221; factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.
- D. Field Fabrication:
  - 1. Where field cutting of standard lengths of channel are required, make cuts straight and perpendicular to manufactured surfaces.
  - 2. For field-cut or damaged surfaces of coated channels, dress cut ends, damaged surfaces, or both, with an abrasive material (e.g., file, grinding stone, or similar) and cleanser to remove oils, rust, sharp edges and shards.
  - 3. For channel with a factory-applied coating, re-finish cut edges with a coating compatible with the factory finish and as recommended by the manufacturer (e.g., manufacturer's touch-up paint or zinc-rich cold-galvanizing compound, as applicable).

## 2.7 PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 7 section "through-penetration firestop systems."
- B. Roofs:
  - 1. Coordinate all roof penetrations with engineer, owner, and as applicable, the roofing contractor providing a roof warranty.

2. Keep all raceway penetrations within mechanical equipment curbs wherever possible. Coordinate with all other applicable Division's work.
3. Flash and counterflash all openings through roof, and/or provide pre-fabricated molded seals compatible with the roof construction installed, or as required by the engineer, owner, or roofing contractor. All roof penetrations shall be leak-tight at the termination of the work and shall not void any new or existing roof warranties.

C. Walls and Floors

1. Sleeves for raceways and cables
2. Steel pipe sleeves: ASTM A 53/A 53M, type E, grade B, schedule 40, galvanized steel, plain ends and drip rings.
3. Cast-iron pipe sleeves: cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Sleeves for rectangular openings: galvanized sheet steel with minimum 0.138 inch thickness and of width and length to suit application.

## 2.8 FIRE-STOPPING THROUGH PENETRATIONS

- A. Fire-resistant through penetration sealants: two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, raceways, and cable tray penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by underwriters' laboratories, inc., or other NRTL acceptable to AHJ.

B. Acceptable manufacturers:

1. Hilti, Inc.
2. 3m Corp.
3. Rectorseal.
4. Specify Technology Inc.
5. United States Gypsum Company.

C. Submittals

1. Submit product data, manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Division 1.
2. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment shall include both project name and contractor's name who will install firestop system as described in drawings.
3. Submit material safety data sheets provided with product delivered to job-site.

## 2.9 CONCRETE BASES

- A. Provide concrete bases (e.g., housekeeping pads) for equipment where indicated on the drawings and as specified herein. Concrete bases shall have chamfered edges. Size of base shall be a minimum of 2 inches greater than the footprint of the equipment that it is supporting.
- B. Construct equipment bases of a minimum 28-day, 4000-psi concrete conforming to American Concrete Institute standard building code for reinforced concrete (ACI 318-99) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C 150 type I, aggregate conforming to ASTM C33, and potable water. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.
- C. Unless otherwise specified or shown on the structural drawings, reinforce equipment bases with no. 4 reinforcing bars conforming to ASTM A 615 or 6x6 – w2.9 x w2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.
- D. Provide galvanized anchor bolts for equipment placed on concrete bases or on concrete slabs. Anchor bolts size, number and placement shall be as recommended by the manufacturer of the equipment.
- E. Concrete equipment bases shall have a minimum height of 4 inches and shall be poured-in-place.

## 2.10 ACCESS DOORS

- A. Provide access doors in ceilings and walls, where indicated or required for access or maintenance to concealed equipment installed under this section. Provide concealed hinges, screwdriver-type lock, and anchor straps.
- B. Manufactured by Milcor, Zurn, Titus, or equal. Obtain architect's approval of type, size, location and color before ordering.

## 2.11 EQUIPMENT FURNISHED BY OTHERS

- A. Provide necessary equipment and accessories that are not provided by the equipment supplier or owner to complete installation of equipment furnished by others, in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include such items as flexible cords and plugs, as required for proper operation of the complete system, in accordance with the manufacturers' instructions.
- B. Be responsible for correct rough-in dimensions, and verify them with engineer, owner's representative, equipment supplier, or all three, prior to rough-in and service installations.

## 2.12 CLEANING

- A. In addition to the requirements of Division 1, remove from the premises dirt and refuse resulting from the performance of the electrical work, as required, to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from the work. Clean all material and equipment installed under this division. Remove dirt, dust, plaster, stains and foreign matter from all surfaces. Touch up and restore all damaged finishes to their original condition.

## 2.13 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align, and test all electrical equipment on this project provided under this division and all

electrical equipment furnished by others for installation or wiring under this division, for proper operation.

- B. Test all systems and equipment according to the requirements in NETA ATS (latest edition) and all additional requirements specified in following sections.
- C. Maintain the following on the project premises at all times: a true RMS reading voltmeter, a true RMS reading ammeter, and a megohmmeter insulation resistance tester. Provide test data readings as requested or as required by the engineer.

## 2.14 EQUIPMENT IDENTIFICATION

A. Provide equipment identification nameplates:

- 1. On all panelboards, switches, starters, dimmers, switches in distribution panelboards and switchboards and where indicated on the drawings.

B. Nameplates:

- 1. Engraved, contrasting color, three-layer, laminated plastic indicating the name of the equipment, load, or circuit as designated on the drawings and in the specifications:
  - A) Field-applied permanent epoxy adhesive, compatible with the equipment finish.
  - B) Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.
- 2. Color: black background with white letters for normal power; red background with white letters for emergency power. Letter height: ½ inch minimum.

## 2.15 SYSTEM START UP

A. Prior to starting up the electrical systems:

- 1. Check all components and devices.
- 2. Lubricate items accordingly.
- 3. Tighten screws and bolts for connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486a and UL 486b.
- 4. Adjust taps on each transformer for rated secondary voltage when the transformer is at minimum load.
- 5. Check and record building's service entrance voltage, grounding conditions, grounding resistance, and proper phasing.
- 6. Replace all burned-out lamps and lamps used for temporary construction lighting in permanent light fixtures.
- 7. Balance all single-phase loads at each panelboard, redistributing branch circuit connections until balance is achieved. Do not type up final panelboard directories until all re-balancing and redistribution of circuits are complete. Turn on all loads in an attempt to maximize the load on the panel and take ampere readings on each of the phases before redistributing circuits and balancing the panel.



8. After all systems have been inspected and adjusted, confirm all operating features required by the drawings and specifications and make final adjustments as necessary.

### PART 3 - EXISTING EQUIPMENT REUSE AND REMOVAL

- A. Remove all existing wiring, light fixtures, exposed conduits and other electrical installations not reused prior to substantial completion of the work.
- B. Existing raceways may be reused if their points of terminations are suitable; if they are clean inside with no evidence of rust or burrs; if free from cracks, flattened sections or sharp bends; and, if suitably located to avoid conflicts with other trades or installations. Carefully "fish" all existing conduits reused under this contract to remove all debris and obstructions, and swab until all moisture is removed.
- C. Cut, patch, and repair where required for new electrical installations, and patch and repair all surface damage resulting from this work. Cut flush with the floor and plug at both ends, raceways stubbed above the floor and not used at substantial completion of the work.
- D. Relocate all existing electrical systems required to be in operation at substantial completion of the contract, if required, as a result of work included under this contract, even if not specifically indicated in the drawings or specifications.

### PART 4 - ALTERNATES

- A. Provide all work contemplated under the different alternates to include labor, materials, equipment and services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bids for each alternate applicable to contractor's proposal, stating the amount to be added or deducted from the base bid in case the alternate is accepted. Comply with applicable sections of the base specifications for work required by the alternate unless otherwise specified. Refer to the architectural portion of the specification.

END OF SECTION

## SECTION 26 05 19

### LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Aluminum building wire rated 600 V or less.
  - 3. Metal-clad cable, Type MC, rated 600 V or less.
  - 4. Armored cable, Type AC, rated 600 V or less.
  - 5. Connectors, splices, and terminations rated 600 V and less.

##### 1.2 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Product Schedule: Indicate type, use, location, and termination locations.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

##### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## **PART 2 - PRODUCTS**

### **2.1 COPPER BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B496 for stranded conductors.
- D. Conductor Insulation:
  - 1. Type NM: Comply with UL 83 and UL 719.
  - 2. Type RHH and Type RHW-2: Comply with UL 44.
  - 3. Type USE-2 and Type SE: Comply with UL 854.
  - 4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
  - 5. Type THHN and Type THWN-2: Comply with UL 83.
  - 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 7. Type UF: Comply with UL 83 and UL 493.
  - 8. Type XHHW-2: Comply with UL 44.
- E. Shield:
  - 1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

### **2.2 ALUMINUM BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- D. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHH and Type RHW-2: Comply with UL 44.
3. Type USE-2 and Type SE: Comply with UL 854.
4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
5. Type THHN and Type THWN-2: Comply with UL 83.
6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
7. Type XHHW-2: Comply with UL 44.

### **2.3 METAL-CLAD CABLE, TYPE MC**

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Comply with UL 1569.
  3. RoHS compliant.
  4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
  1. Single circuit and multicircuit with color-coded conductors.
  2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor: Bare.
- F. Conductor Insulation:
  1. Type TFN/THHN/THWN-2: Comply with UL 83.
  2. Type XHHW-2: Comply with UL 44.
- G. Armor: Aluminum, interlocked.
- H. Jacket: PVC applied over armor.

### **2.4 ARMORED CABLE, TYPE AC**

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.
- B. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.

3. Comply with UL 4.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Ground Conductor: Bare.

F. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

G. Armor: Aluminum, interlocked.

## **2.5 CONNECTORS AND SPLICES**

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

D. MC cable shall not be used for home runs unless approved prior to bid in writing by the EOR. Contractor shall notify the EOR in writing their intent to use MC cable for any application in the building prior to bidding.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- J. VFC Output Circuits: Type XHHW-2 in metal conduit.

### **3.3 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 05 36 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### **3.4 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

### **3.5 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
- C. All conductor insulation shall be continuously colored to match phase types according to NFPA standards.

### **3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### **3.7 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

### **3.8 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors feeding critical equipment.
  - 3. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.

- f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
  - g. Continuity test on each conductor and cable.
  - h. Uniform resistance of parallel conductors.
4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
- a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
- 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION



## SECTION 26 05 26

### GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency and testing agency's field supervisor.
- B. Field quality-control reports.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

##### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

#### PART 2 - PRODUCTS

##### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

##### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

- B. Bare Copper Conductors:
1. Solid Conductors: ASTM B3.
  2. Stranded Conductors: ASTM B8.
  3. Tinned Conductors: ASTM B33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

### 2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- O. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.
  - a. Material: Die-cast zinc alloy.
  - b. Listed for direct burial.
2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## **2.4 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
  1. Bury at least 30 inches below grade.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
  1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  3. Connections to Ground Rods at Test Wells: Bolted connectors.
  4. Connections to Structural Steel: Welded connectors.

### **3.2 GROUNDING AT THE SERVICE**

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### **3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS**

- A. Comply with IEEE C2 grounding requirements.

- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

### 3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. Use exothermic welds for all below-grade connections.
  - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
  - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
  - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
  5. Substations and Pad-Mounted Equipment: 5 ohms.
  6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

## SECTION 26 05 33

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
  - 7. Handholes and boxes for exterior underground cabling.

##### 1.2 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Sustainable Design Submittals:

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Source quality-control reports.

#### PART 2 - PRODUCTS

##### 2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
  - 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. GRC: Comply with ANSI C80.1 and UL 6.

3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - a. Comply with NEMA RN 1.
  - b. Coating Thickness: 0.040 inch, minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:
  - a. Material: Steel.
  - b. Type: Setscrew.
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:
  - a. Comply with NEMA TC 14.
  - b. Comply with UL 2515 for aboveground raceways.
  - c. Comply with UL 2420 for belowground raceways.
3. ENT: Comply with NEMA TC 13 and UL 1653.
4. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
5. LFNC: Comply with UL 1660.
6. Rigid HDPE: Comply with UL 651A.
7. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.



2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  - a. Fittings for LFNC: Comply with UL 514B.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

### **2.3 METAL WIREWAYS AND AUXILIARY GUTTERS**

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.
  1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

### **2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS**

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

### **2.5 SURFACE RACEWAYS**

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's

standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

## **2.6 BOXES, ENCLOSURES, AND CABINETS**

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
  - 1. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
  - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- L. Gangable boxes are allowed.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Fiberglass.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
  - 1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING**

- A. General Requirements for Handholes and Boxes:
  1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  1. Standard: Comply with SCTE 77.
  2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC."
  6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
  
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete.
  1. Standard: Comply with SCTE 77.
  2. Color of Frame and Cover: Gray.
  3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  6. Cover Legend: Molded lettering, "ELECTRIC."
  7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## **2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES**

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  1. Tests of materials shall be performed by an independent testing agency.
  2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## **PART 3 - EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: GRC.
  - 2. Concealed Conduit, Aboveground: EMT.
  - 3. Underground Conduit: RNC, Type EPC-80-PVC,.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
  
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
    - d. Gymnasiums.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 6. Damp or Wet Locations: GRC.
  - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
  
- C. Minimum Raceway Size: 3/4-inch trade size.
  
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
  
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
  
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
  
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from ENT to GRC before rising above floor.
- L. Stub-Ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- U. Surface Raceways:
  - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
  - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Conduit extending from interior to exterior of building.
  - 4. Conduit extending into pressurized duct and equipment.
  - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  - 6. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Y. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where

- environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- GG. Set metal floor boxes level and flush with finished floor surface.
- HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### **3.3 INSTALLATION OF UNDERGROUND CONDUIT**

#### **A. Direct-Buried Conduit:**

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

### **3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade. Consult with civil engineer for frost line depth at site location.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.



### **3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### **3.6 FIRESTOPPING**

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### **3.7 PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

## SECTION 26 05 43

### UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
  2. Rigid nonmetallic duct.
  3. Flexible nonmetallic duct.
  4. Duct accessories.
  5. Precast concrete handholes.
  6. Polymer concrete handholes and boxes with polymer concrete cover.
  7. Fiberglass handholes and boxes with polymer concrete cover.
  8. Fiberglass handholes and boxes.
  9. High-density plastic boxes.
  10. Precast manholes.
  11. Cast-in-place manholes.
  12. Utility structure accessories.

##### 1.2 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
1. Two or more ducts installed in parallel, with or without additional casing materials.
  2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include duct-bank materials, including spacers and miscellaneous components.
  2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  3. Include accessories for manholes, handholes, boxes, and other utility structures.
  4. Include underground-line warning tape.
  5. Include warning planks.

- B. Sustainable Design Submittals:

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C858.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### **1.5 MAINTENANCE MATERIALS SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

#### **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

#### **1.7 FIELD CONDITIONS**

- A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUIT AND FITTINGS**

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## **2.2 RIGID NONMETALLIC DUCT**

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- C. Solvents and Adhesives: As recommended by conduit manufacturer.

## **2.3 DUCT ACCESSORIES**

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 26 05 53 "Identification for Electrical Systems."

## **2.4 PRECAST CONCRETE HANDHOLES AND BOXES**

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Comply with ASTM C858 for design and manufacturing processes.
- C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- E. Cover Legend: Molded lettering, "ELECTRIC." as indicated for each service.
- F. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- G. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
  - 1. Extension shall provide increased depth of 12 inches.
  - 2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- H. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- I. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
  - 1. Center window location.

2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
  3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
  4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
  5. Knockout panels shall be 1-1/2 to 2 inches thick.
- J. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
1. Type and size shall match fittings to duct to be terminated.
  2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
- K. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## **2.5 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER**

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC."
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.6 FIBERGLASS HANDHOLES AND BOXES WITH POLYMER CONCRETE FRAME AND COVER**

- A. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC."
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.7 FIBERGLASS HANDHOLES AND BOXES**

- A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of reinforced concrete.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC."
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.8 HIGH-DENSITY PLASTIC BOXES**

- A. Description: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of polymer concrete.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC."
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.9 PRECAST MANHOLES**

- A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
- B. Comply with ASTM C858.
- C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.
- D. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
  - 1. Center window location.

2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
  3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
  4. Knockout panel shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
  5. Knockout panels shall be 1-1/2 to 2 inches thick.
- E. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
1. Type and size shall match fittings to duct to be terminated.
  2. Fittings shall align with elevations of approaching duct and be located near interior corners of manholes to facilitate racking of cable.
- F. Ground Rod Sleeve: Provide a 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.
- G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

## **2.10 CAST-IN-PLACE MANHOLES**

- A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for duct entrance and sleeve for ground rod.
- B. Materials: Comply with ASTM C858 and with Section 03 30 00 "Cast-in-Place Concrete."
- C. Structural Design Loading: As specified in "Underground Enclosure Application" Article.

## **2.11 UTILITY STRUCTURE ACCESSORIES**

- A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.
- B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
  1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
    - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
  2. Cover Legend: Cast in. Selected to suit system.
    - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
    - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.



3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
  - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C387, Type M, may be used.
  - b. Seal joints watertight using preformed plastic or rubber complying with ASTM C990. Install sealing material according to sealant manufacturers' written instructions.
  
- C. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.
  
- D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-4-inch bolt.
  1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
  
- E. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch-diameter eye, rated 2500-lbf minimum tension.
  
- F. Pulling-in and Lifting Irons in Concrete Floors: 7/8-inch-diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
  1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
  
- G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
  1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
  
- H. Ground Rod Sleeve: 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.
  
- I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
  
- J. Cable Rack Assembly: Steel, hot-rolled galvanized, except insulators.
  1. Stanchions: T-section or channel with provisions to connect to other sections or channels to form a continuous unit; 1-1/2 inches in width by nominal 24 inches long; punched with 14 hook holes on 1-1/2-inch centers for cable-arm attachment.
  2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
  3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
  
- K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
  1. Stanchions: Nominal 36 inches high by 4 inches wide, with provisions to connect to other sections to form a continuous unit, with minimum of nine holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- L. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- M. Fixed Manhole Ladders: Arranged for attachment to wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- N. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches. One required.
- O. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

## **2.12 SOURCE QUALITY CONTROL**

- A. Test and inspect precast concrete utility structures according to ASTM C1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  1. Tests of materials shall be performed by an independent testing agency.
  2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain.

### **3.2 UNDERGROUND DUCT APPLICATION**

- A. Duct for Electrical Feeders 600 V and Less: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated.
- B. Duct for Electrical Branch Circuits: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated.
- C. Bored Underground Duct: Type EPEC-80-HDPE unless otherwise indicated.
- D. Underground Ducts Crossing Paved Paths and Driveways: Type EPC-40 PVC RNC, encased in reinforced concrete.
- E. Stub-ups: Concrete-encased GRC.

### **3.3 UNDERGROUND ENCLOSURE APPLICATION**

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-10 structural load rating.
  - 2. Cover design load shall not exceed the design load of the handhole or box.
- B. Manholes: cast-in-place concrete.
  - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
  - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

### **3.4 EARTHWORK**

- A. Refer to civil engineer drawings for earthwork details and specifications.

### **3.5 DUCT AND DUCT-BANK INSTALLATION**

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.
- I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- K. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.
- L. Concrete-Encased Ducts and Duct Bank:
  - 1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 20 00 "Earth Moving" for pipes less than 6 inches in nominal diameter.
  - 2. Width: Excavate trench 12 inches wider than duct on each side.
  - 3. Width: Excavate trench 3 inches wider than duct on each side.

4. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
8. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
9. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
  - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be flush with finished floor and minimum 3 inches from conduit side to edge of slab.
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be flush with finished floor and no less than 3 inches from conduit side to edge of slab.
10. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
  - a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
  - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 30 00 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

M. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 31 20 00 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 12 inches wider than duct on each side.
3. Width: Excavate trench 3 inches wider than duct on each side.
4. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
8. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
  - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be flush with finished floor and minimum 3 inches from conduit side to edge of slab.
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be flush with finished floor and no less than 3 inches from conduit side to edge of slab.
11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of

run and complete backfilling with normal compaction. Comply with requirements in Section 31 20 00 "Earth Moving" for installation of backfill materials.

- a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
  - b. Place minimum 6 inches of engineered fill above concrete encasement of duct.
- N. Warning Planks: Bury warning planks approximately 12 inches above direct-buried duct, placing them 24 inches o.c. Align planks along the width and along the centerline of duct or duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.
- O. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 26 05 53 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### **3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES**

- A. Cast-in-Place Manhole Installation:
1. Finish interior surfaces with a smooth-troweled finish.
  2. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
  3. Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.
- B. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C891 unless otherwise indicated.
  2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
  3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
  2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
  3. Install handholes with bottom below frost line, below grade.
  4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
  2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.
- F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
- G. Damp proofing: Apply damp proofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Damp proofing materials and installation are specified in Section 07 11 13 "Bituminous Damp proofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
- H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### **3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and



with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Section 03 30 00 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

### **3.8 GROUNDING**

- A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
  2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
  3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### **3.10 CLEANING**

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
  1. Sweep floor, removing dirt and debris.
  2. Remove foreign material.

END OF SECTION

## SECTION 26 05 44

### SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

##### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

#### PART 2 - PRODUCTS

##### 2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Stainless steel.
  3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS**

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### **3.3 SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

## SECTION 26 05 53

### IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

##### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

#### PART 2 - PRODUCTS

##### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
  
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be continuous colored insulation.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Color for Neutral: White.
  - 4. Color for Equipment Grounds: Green.
  
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
  
- D. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.
  
- E. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
  
- F. Equipment Identification Labels:
  - 1. Black letters on a white field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
  
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
  
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".



- c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
3. Tag: Type II:
- a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
  - b. Width: 3 inches.
  - c. Thickness: 12 mils.
  - d. Weight: 36.1 lb/1000 sq. ft..
  - e. Tensile according to ASTM D882: 400 lbf and 11,500 psi.
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

## 2.7 SIGNS

- A. Baked-Enamel Signs:
  - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    - b. For signs larger than 20 sq. in., 1/8 inch thick.
    - c. Engraved legend with black letters on white face.
    - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## **2.8 CABLE TIES**

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.

## **2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### **3.2 INSTALLATION**

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.

- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
  - 3. "UPS."
- M. Vinyl Wraparound Labels:
  - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
  - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
  2. Limit use of underground-line warning tape to direct-buried cables.
  3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Metal Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- Y. Nonmetallic Preprinted Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- Z. Write-on Tags:
1. Place in a location with high visibility and accessibility.
  2. Secure using plenum-rated cable ties.
- AA. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

BB. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

CC. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 15 A and 100 V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 10-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  2. Label shall include circuit number and panel of origin.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive labels.
- O. Operating Instruction Signs: Self-adhesive labels.
- P. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- Q. Equipment Identification Labels:
  - 1. Indoor Equipment: Self-adhesive label.
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
  - 3. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Enclosed switches.
    - e. Enclosed circuit breakers.
    - f. Enclosed controllers.
    - g. Variable-speed controllers.
    - h. Contactors.
    - i. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION

**SECTION 26 27 13**  
**ELECTRICITY METERING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes work to accommodate utility company revenue meters, and Owner's electricity meters used to manage the electrical power system.

**1.3 DEFINITIONS**

- A. KY or KYZ Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity (kWh) that is based on a relay opening and closing in response to the rotation of the disk in the meter. Electronic meters generate pulses electronically.

**1.4 ACTION SUBMITTALS**

- A. Product Data:
  - 1. For each type of meter.
  - 2. For metering infrastructure components.
- B. Shop Drawings: For electricity-metering equipment.
  - 1. Include elevation views of front panels of control and indicating devices and control stations.
  - 2. Include diagrams for power, signal, and control wiring.
  - 3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
  - 4. Include series-combination rating data for modular meter centers with main disconnect device.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.



- C. Sample Warranty: For special warranty.

## **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An NRTL.

## **1.7 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Damage from transient voltage surges.
  - 2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.
  - 3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

## **1.8 COORDINATION**

- A. Electrical Service Connections:
  - 1. Coordinate with utility companies and utility-furnished components.
    - a. Comply with requirements of utility providing electrical power services.
    - b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 916.

### **2.2 UTILITY METERING INFRASTRUCTURE**

- A. Install metering accessories furnished by the utility company, complying with its requirements.
- B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.
  - 1. Data Transmission: Transmit pulse data over control-circuit conductors, classified as Class 1 per NFPA 70, Article 725.

- C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- D. Meter Sockets:
  - 1. Comply with requirements of electrical-power utility company.
  - 2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.
- E. Arc-Flash Warning Labels;
  - 1. Labels: Comply with requirements for "Arc-Flash Warning Labels" in Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study." Apply a 3-1/2-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.
    - a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
      - 1) Location designation.
      - 2) Nominal voltage.
      - 3) Flash protection boundary.
      - 4) Hazard risk category.
      - 5) Incident energy.
      - 6) Working distance.
      - 7) Engineering report number, revision number, and issue date.

## 2.3 ELECTRICITY METERS

- A. System Description: Able to meter designated activity loads, with or without external alarm, control, and communication capabilities, or other optional features.
  - 1. Comply with ANSI C12.1 and ANSI C12.20, 0.2 accuracy class.
  - 2. Ambient Temperature: Minus 22 deg F to plus 158 deg F.
  - 3. Humidity: Zero to 95 percent, noncondensing.
- B. General Requirements for Meters:
  - 1. Certify that meters comply with ANSI C12.20 requirements by a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology (NIST). The laboratory shall use test equipment that is certified annually and is traceable to NIST standards.
  - 2. Enclosure: Supplied by meter manufacturer, NEMA 250, Type 3R minimum, with provisions for locking or sealing.
  - 3. Identification: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
    - a. Type: Split core, complying with recommendation of meter manufacturer.
- C. kWh Meter: Electronic single-phase and three-phase meters, measuring electricity use.
  - 1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
- D. Current-Transformer Cabinet: Size and configuration as recommended by metering equipment manufacturer for use with indicated connected feeder and sensors.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install modular meter center according to switchboard installation requirements in NECA 400.
- D. Install arc-flash labels as required by NFPA 70.
- E. Wiring Method:
  - 1. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
  - 2. Minimum conduit size shall be 1-1/4 inch.

### **3.2 IDENTIFICATION**

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Series Combination Warning Label: Self-adhesive labels, with text as required by NFPA 70.
  - 2. Equipment Identification Labels: Self-adhesive labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

END OF SECTION

## SECTION 31 22 19 - SITE GRADING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Stripping and storage of topsoil, excavating, filling, grading, and other related work to prepare the site.
- B. Refer to Plan General Notes and Project Geotechnical Report(s) for additional project specific information. All soil placed in fill or embankment areas shall be approved or in accordance with Geotechnical Engineers recommendations.

#### 1.2 DEFINITIONS

- A. Unclassified Excavation: Shall consist of the material excavation and placement regardless of its nature. All excavation shall be considered unclassified unless specifically stated in the Bid Schedule.
- B. Rock Excavation: Removal of material shall be considered rock excavation when it consists of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting or the use of a tractor having a power rating in excess of 370 horsepower, with a rear-mounted, heavy-duty, single-tooth, ripping attachment.
- C. Common Excavation: Removal of materials which can be excavated using a rear-mounted, heavy-duty, single-tooth ripping attachment mounted on a crawler tractor with a power rating of 370 horsepower or less shall be considered common excavation.
- D. Muck Excavation: Shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation material regardless of moisture content.
- E. Fill Material: Shall be mineral soil free from peat, frozen material, brush, trees, roots over 50 mm (2 inches) in diameter and rocks over 150 mm (6 inches) in greatest diameter obtained from site during excavation.
- F. Topsoil: Surface soil approximately 150 mm (6 inches) in depth that supports growth of vegetation and contains organic matter. Topsoil shall be free from subsoil, debris, and stones larger than 25 mm (1 inch) in diameter.

#### 1.3 QUALITY ASSURANCE

- A. Failure Criteria: Not limited to the following:
  - 1. Formation of pools of moisture where positive drainage is intended for proper function or otherwise indicated on the drawings.
  - 2. Settlement of fill.
  - 3. Flow of moisture toward, or entrapment against, structures or building foundations.

#### 1.4 PROJECT/SITE CONDITIONS

- A. Environmental Conditions: Do not attempt to grade frozen or saturated material. Water dry material to prevent dust.

### PART 2: PRODUCTS

#### 2.1 MATERIALS

- A. General: See definitions.
  - 1. Silt Barrier: A silt barrier shall be constructed to prevent silt from traveling off site. The geotextile fabric shall be made of ultra-violet resistant material, silt-film fabric having the following characteristics:
    - a. Grab strength, according to ASTM D 4632: 90 lbs.(200 kg)
    - b. Burst strength, according to ASTM D 751: 145 lbs.(320 kg)
    - c. Elongation, according to ASTM D 4632: 15 percent @ 45 lbs.(100 kg)
    - d. Permeability coefficient, according to ASTM D 4491, at a constant head of 50 mm: 0.2 mm/sec.
    - e. Apparent opening size, according to ASTM D 4751: U.S. Standard Sieve Number 20 minimum.
    - f. Retained strength after accelerated weathering and ultra-violet exposure, according to ASTM D 4355: 70 percent.

## PART 3: EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Verify the grade elevations existing on the site. Notify the Owner's Representative immediately if existing site elevations differ from those shown in the project drawings and when adjustments are required to provide finish elevations indicated. Site drainage shall be considered of prime importance.

Contractor shall review plan sheets, general construction notes and geotechnical investigations and report for additional requirements. Plan notes shall supercede these specifications.

### 3.2 PREPARATION

- A. Clearing: Section 31 11 00 - Clearing and Grubbing.
- B. Stripping Topsoil: Strip and stockpile topsoil in the location approved by the Owners Representative.
- C. Scarifying: Sod and vegetation shall be removed from the surface upon which the fill shall be placed. The cleared surface shall be completely broken up by scarifying to a minimum depth of 8 inches. Scarifying furrows shall be a maximum of 3 feet (900 mm) apart and shall be parallel to the center line of the fill. No fill materials shall be placed upon unapproved surface.

### 3.3 INSTALLATION

- A. Excavation: Section 31 23 00 - Excavation and Fill.
- B. Grades: When not otherwise indicated shall be level, or uniform slopes between points where elevations are given, or between such points and existing finished grades. Changes in slopes shall be rounded. Grades shall slope away from structure. Contractor shall insure that positive drainage is maintained at all times to prevent ponding of water. Typically spot elevations given are to top of sod or paving. Contractor shall adjust grading elevations as necessary to account for final surface.
- C. Compaction Methods: Fill material shall be spread over the full area of the cross section of the fill to a maximum loose layer thickness of 8 inches. Compact according to Section 312300 - Excavation and Fill, before the next layer is spread. Use vibratory, pneumatic tire, smooth-steel wheel, or sheepsfoot rollers to obtain the required degree of compaction. During placing and compacting of the fill material, the optimum moisture content shall be maintained by wetting or drying as required. Slopes shall be benched before placement of fill on said slopes.
- D. Frozen Material: Fill shall not be placed when either the material or the surface on which it is to be placed is frozen.

- E. Homogeneous Mass: Successive loads of material shall be dumped on the earthfill to produce the best practicable distribution of the material. The in-place materials shall be free of lenses, pockets, streaks, or layers of materials differing substantially in texture or gradation from the surrounding materials.
- F. Topsoil: Topsoil to be used for landscaping shall be spread uniformly over compacted material to grades, 6 inches thick minimum, and compacted firmly in place. Upon completion of grading operations, spread topsoil from the stockpile onto lawn areas and areas disturbed by grading operations.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Furnish necessary equipment, labor, and materials to conduct the testing. Testing shall be conducted in the presence of the Owner's Representative who shall be given 48-hour notice before tests are to be conducted. Arrange for a certified independent testing laboratory, according to the requirements of Section 01 45 29 - Testing Laboratory Services, to perform the required testing, recording, and distributing of the results.
- B. Compaction: Fill material shall be compacted to a minimum density of 95 percent of the maximum dry density obtained by AASHTO T 99, Method C, unless noted otherwise.

END OF SECTION

## SECTION 31 23 00 - EXCAVATION AND FILL

### PART 1: GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Excavation, borrow excavation, embankment construction, placement, and disposal of materials as shown on the drawings.
- B. Related Sections
  - Testing Laboratory Services Section 01 45 29
  - Clearing and Grubbing Section 31 11 00

#### 1.2 DEFINITIONS

- A. Unclassified Excavation: Consists of the material excavation and placement regardless of its nature. All excavation and fill shall be considered Unclassified unless types B through E, listed below, are specifically listed in the Bid Schedule.
- B. Rock Excavation: Removal of material is rock excavation when it consists of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting or the use of a tractor having a power rating in excess of 370 horsepower, with a rear-mounted, heavy-duty, single-tooth, ripping attachment.
- C. Common Excavation: Removal of materials which can be excavated using a rear-mounted, heavy-duty, single-tooth ripping attachment mounted on a crawler tractor with a power rating of 370 horsepower or less shall be considered common excavation.
- D. Muck Excavation: Shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation material regardless of moisture content.
- E. Fill Material: Shall be suitable mineral soil free from organics, frozen material, brush, trees, roots over 2 inches (50 mm) in diameter and rocks over 6 inches (200 mm) in greatest diameter obtained from site during excavation. Fill material quality may be specified to meet certain project requirements. Refer to plan notes and project geotechnical report for specific requirements.
- C. Topsoil: Surface soil approximately 6 inches (150 mm) in depth that supports growth of vegetation and contains organic matter. Topsoil shall be free from subsoil, debris, and stones larger than 1 inch (25 mm) in diameter.

#### 1.3 PROJECT/SITE CONDITIONS

- A. Excess Material: Usable excess material excavated shall be used in the embankment construction before the use of borrow is allowed. Borrow wasting is not permitted.
- B. Borrow Material Source: Furnish the borrow material source, unless an a source or sources shown on the drawings, subject to use restrictions or requirements as noted.
- C. Fencing: When fencing is removed, replace the fencing to the same condition as it was before removal. The Contractor shall be responsible for the livestock confinement when a portion of a fence is removed.

- D. Drainage of Borrow Pits: Borrow pits, gravel pits, quarry sites, and waste or disposal areas shall be excavated so that water will not collect and stand.

## PART 2: PRODUCTS

### 2.1 MATERIALS

- A. General: See definitions.
- B. Fill Material: Shall be obtained from the unclassified excavation, or from approved borrow areas. Material from excavation shall be used unless it contains frozen earth, debris, does not comply with any quality restrictions, or is specified in other sections to be replaced. Materials removed in clearing and grubbing shall not be used for backfill or embankment.

## PART 3: EXECUTION

### 3.1 PREPARATION

- A. Clearing and Grubbing: The area to be excavated, and the surface area to be covered by fill material, shall be thoroughly cleared and stripped of vegetative matter, brush, trees, stumps, roots, loose rocks, and other objectionable materials including sand, gravel, silt, and debris in channels within the foundation areas. Dispose of debris.
- B. Borrow Areas: Notify the Owner's Representative sufficiently(14 Days) in advance of opening borrow areas. This allows cross section determination of elevations and measurements of the ground surface after stripping. also, the borrow material can be tested before being used. Allow sufficient time for testing the borrow(14 Days). Borrow areas shall be bladed and left in such shape as to permit accurate measurements after excavation has been completed. Do not excavate beyond the dimensions and elevations established, and no material shall be removed prior to staking out and cross-sectioning of the site. The finished borrow areas shall be approximately true to the line and grade established by agreement.
- C. Prewatering: Excavation areas and borrow pits may be prewatered before excavating the material. The area to be excavated shall be moistened to the full depth from the surface to the bottom of the excavation. The application of water shall be controlled so that the excavated material will be near the optimum moisture content as specified in paragraph 3.3A Testing, below. When necessary, prewatering shall be supplemented to assure that embankment material and backfill material moisture content comply with paragraph 3.3A Testing, below.
- D. Preparation for Grading: Prior to beginning embankment operations in an area, necessary clearing and grubbing in that area shall have been completed and accepted by the Owners Representative. No embankment materials shall be placed upon an unapproved surface.
  - 1. Embankment Greater Than 4 feet (1200 mm) High: When embankments greater than 4 feet (1200 mm) are to be constructed, the cleared surface shall be completely broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm). Scarifying or furrows shall be a maximum of 3 feet (900 mm) apart, and shall be parallel to the centerline of the embankment. This area shall then be compacted beginning with the first lift, as specified in paragraphs 3.3B Moisture Content and 3.3C Compaction.
  - 2. Embankment 4 feet (1200 mm) High or Less: When embankments 4 feet (1200 mm) high or less are to be constructed, sod and vegetation shall be removed from the surface upon which the embankment is to be placed, and the surface of the original ground shall be scarified as described in paragraph 3.1D1, and shall be compacted as described in paragraphs 3.3B Moisture Content and 3.3C Compaction, before starting the embankment operation.

### 3.2 INSTALLATION

- A. Explosives: The use of explosives is prohibited.



- B. Excavation: Excavate where shown on the drawings and typical sections, unless staked otherwise. Excavate on a straight grade between the control points shown on the drawings unless staked otherwise. Existing structures which are disturbed or damaged by construction activity shall be reset, repaired, or replaced at the Contractor's expense.
- C. Subgrade Compaction: In areas where earthfill, or granular embankments are to be constructed and in areas where excavation exposes the subgrade surface upon which improvements will be constructed, the subgrade shall be compacted as specified in paragraphs 3.3B Moisture Content and 3.3C Compaction below, before embankment construction begins.
- D. Disposal of Materials: Excess and unsuitable material, including rock and boulders that cannot be used in embankments, shall be disposed of off-site unless otherwise approved by the Owners Representative.
- E. Use of Borrow Material: Do not use borrow material until after the suitable materials obtained from required excavation have been placed in the fill, unless otherwise directed by the Owners Representative. When more borrow is placed than is required, and required excavation is wasted, the waste shall be replaced in the borrow area at the Contractor's expense.
- F. Overburden: Overburden shall be stripped from borrow pits, aggregate pits, and quarries, and stockpiled for later use. After a pit has served its purpose, waste material outside of the pit shall be moved back into the pit. The pit shall be neatly sloped and trimmed. Side slopes shall be flattened to a 4:1 slope. Stockpiled overburden material shall then be spread uniformly over the sides and bottom of the pit area, and vegetation established.
- G. NOT USED
- H. Fill Material: Slope surfaces shall be horizontally benched before placement of fill on slopes. Fill shall be spread over the full width of the cross section of the embankment to a maximum loose thickness of 8 inches (200 mm), and shall be compacted as specified in paragraphs 3.3B Moisture Content and 3.3C Compaction below, before the next layer is spread. Use sheepsfoot, vibratory, pneumatic tire, or smooth-steel wheel rollers to obtain the required degree of compaction. The in-place materials shall be free of lenses, pockets, streaks, or layers of materials differing substantially in texture or gradation from the surrounding materials. Proof rolling shall be performed as indicated on the plans.
- I. Frozen Material: Shall not be placed, nor be placed upon a frozen surface.

### 3.3 FIELD QUALITY CONTROL

- A. Testing: Furnish necessary equipment, labor, and materials to conduct the testing. Testing shall be conducted in the presence of the Owners Representative who shall be given 48 hours notice before any test is to be conducted. Arrange for a certified independent testing laboratory, according to the requirements of Section 01 45 29 - Testing Laboratory Services, to perform the required testing, recording, and distributing of the results.
- B. Moisture Content: During placing and compacting of fill material, the optimum moisture content (-2 percent to +2 percent) as determined by AASHTO T 217 or AASHTO T 239, unless otherwise approved, shall be maintained by wetting or drying. Moisture range may vary depending upon material. Contractor shall place material in accordance with recommendations provided by Geotechnical Engineers recommendations, if available.
- C. Compaction: The fill material shall be compacted to a minimum density of 95 percent of the maximum dry density as determined by AASHTO T 99, Method C unless noted otherwise.

END OF SECTION

## SECTION 31 23 33 - TRENCHING

### PART 1: GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Trenching, backfilling, and compacting for the installation of utility lines.

#### 1.2 DEFINITIONS

- A. Unclassified Excavation: Shall consist of the material excavated, including earth, shale, rock, gravel, debris or other material excavated or otherwise removed in the preparation of the trench and its handling, placement, or disposal.

#### 1.3 QUALITY ASSURANCE

- A. Failure Criteria: Not limited to the following:
  1. Settlement of backfill below natural ground surface.
  2. Evidence of leakage of the piping.
  3. Malfunctioning of buried electrical or piping systems.

#### 1.4 PROJECT AND SITE CONDITIONS

- A. Borrow Sources: Shall be as approved by the Engineer prior to excavation.
- B. Environmental Conditions:
  1. Excavate areas that have become saturated with oil, gasoline, or bituminous products to a depth of 12 inches (300 mm) beyond contaminated materials; backfill with approved material.
  2. Finish slopes according to the drawings. The final surface shall be similar to a surface obtained by using a farm disk or harrow parallel to the contours and shall blend with the adjacent terrain. Hand rake as necessary to remove excess material in areas inaccessible to construction equipment. Grade to produce a well-drained surface. Excess material from trench excavation shall be placed over the backfill in an inverted "U" shape, however it must not impede drainage.

### PART 2: PRODUCTS

#### 2.1 MATERIALS

- A. General: Material excavated shall be considered unclassified.
- B. Backfill Material: When the type of backfill material to be placed above the standard bedding material is not indicated on the Drawings or specified, the backfill may be made with excavated material, provided that such material, in the opinion of the Engineer is suitable for backfill. In the event excavated material is not suitable, standard bedding material shall be used. Backfill material shall not contain ice or frozen earth, debris, or be of a high moisture content. Materials removed in clearing and grubbing shall not be used for backfill. Backfill shall not contain rock larger than 3 inches in diameter.
- C. Standard Bedding Material:
  1. Standard Bedding Material (SBM) shall meet the requirements of ASTM D-2321 or ASTM C12 for the class of materials described in this subsection.
    - Class I. Class I shall be an angular, ¼ in. to 1 ½ in. graded crushed stone.

Class II. Class II shall include coarse sands and gravels with maximum particle size of 1-1/2 in. These materials may have small percentages of fines, but shall be generally granular and non-cohesive, either wet or dry. Class II materials shall include Unified Soil Classification system Soil Types GW, GP, SW and SP.

Class III. Class III shall include fine sands, sand-clay mixtures and gravel-clay mixtures. USCS Soil Types GM, GC, SM and SC are included in this class.

- D. Sod Materials: Shall consist of the grass mat from a lawn or cultured grass area, which has sufficient root mat to remain together when rolled or removed from the trench area. Grass and soil, which will not reasonably remain intact, shall be considered topsoil.

### PART 3: EXECUTION

#### 3.1 PREPARATION

- A. Clearing: Provide minimum disturbance to existing grass and sod. Dispose of debris at a location off site. All debris to become the property of the Contractor.
- B. Topsoil: Strip topsoil, or in the absence of topsoil, strip the top 4 to 6 inches of surface material and store in stockpile areas. Do not excavate into the underlying, original topsoil at stockpiles. Place previously stripped topsoil onto disturbed-earth areas upon completion of the backfilling operation.
- C. Utilities: Before starting excavation, establish the location and extent of underground utilities in the work area. Protect active utility services uncovered by excavation. Notify the Engineer immediately if utilities are damaged. Damage to utilities shall be repaired or replaced at the Contractor's expense.
- D. Cutting Pavement, Curbs, and Gutters: Make cuts with parallel, straight lines, minimum of 1 foot wider than trench width on each side of trench or pit edge.
- E. Protection of Excavation: Construct and maintain shoring, bracing, underpinning, and sheet piling necessary to protect the excavation and adjacent structures.
- F. Dewatering: Keep the excavation dewatered so that pipe, forming, and concrete work can be carried on under dewatered conditions. Dispose of excess water in a manner that will avoid damage to adjacent property.

#### 3.2 INSTALLATION

- A. General:
  - 1. Restore disturbed areas of existing bituminous pavements.
  - 2. Restore disturbed areas of existing concrete structures.
- B. Trench Excavation: Shall be excavated so that pipe can be laid to the alignment and grades shown on the Drawings. Excavate trenches in rock to a depth of at least 4 inches, but not exceeding 12 inches, below pipe bottom. Depth is dependent upon type of pipe. See Details.
  - 1. When over-excavation occurs, repair the area by backfilling with approved bedding material and compacting to 95 percent maximum dry density according to AASHTO T 99, Method C.
  - 2. When frost action occurs, remove frozen soil and replace with approved soil compacted to 95% of maximum dry density as determined by AASHTO T 99, Method C.

3. When soil becomes saturated above the optimum moisture content, manipulate or dry the material to optimum moisture content and compact, or remove soil down to firm material and place backfill before construction proceeds.
- C. Removal of Materials by Explosives: The use of explosives is prohibited unless specifically authorized by OWNER and local authorities.
  - D. Standard Bedding Material (SBM): Shall be placed as shown on the drawings, carefully placed and compacted along the entire length of the pipe to be installed to the limits of trench excavation, until the thickness specified is obtained. Fine grade the trench bottom throughout and provide uniform and continuous support for each section of pipe or conduit except at bell holes or depressions necessary for making proper joints.
    1. Gravity Pipelines: Standard Bedding Material shall be placed simultaneously on each side of pipe and shall be carefully compacted in accordance with the specifications for the type of pipe to be installed.
      - a. Class I SBM requires little or no compaction due to the nature of the angular particles.
      - b. Class II SBM shall be compacted to a minimum of 85% Standard Proctor Density using hand or mechanical tamping methods.
      - c. Class III SBM shall be compacted to a minimum 90% Standard Proctor Density using hand or mechanical methods. Avoid above optimum moisture conditions.
    2. Pressure Pipelines: SBM shall be placed simultaneously on each side of pipe and compacted sufficiently to maintain proper grade and alignment.
  - E. Trench Backfill: Flooding of trench for consolidation of backfill will not be permitted.
    1. Place backfill to avoid damaging or moving the pipe. Place backfill in 6-inch maximum loose lifts to a depth of 1.5 foot over the top of the pipe. Backfill operations shall be completed within 100 ft. or less of the finished line at all times as directed by the Engineer. Provide compaction as required by specifications and material type.
  - F. Utility Line Marking: Shall be done according to Section 33 05 26 - Utility Line Marking.

### 3.3 FIELD QUALITY CONTROL

- A. Testing: Contractor shall furnish necessary equipment, labor, and materials to conduct the testing. Testing shall be conducted in the presence of the Inspector, who shall be given 48 hours notice before any test is to be conducted. Arrange for a certified, independent testing laboratory, according to the requirements of Section 01 45 29 - Testing Laboratory Services, to perform the required testing, recording, and distributing of the results.
- B. Testing of Pipe Lines: Shall be done according to Section 01 45 34 - Testing of Piping Systems.

END OF SECTION

## SECTION 31 25 00-EROSION CONTROL

### 1.0 GENERAL

#### 1.1 DESCRIPTION

The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and construct erosion control measures necessary to protect property and the environment. Included are the following topics:

Provide erosion & stormwater control in accordance with the following references:

- Oklahoma Department of Environmental Quality Stormwater General Permit for Construction Activities, Latest revision or amendment;

Or for projects on Federal/Indian Trust Lands,

- U.S. EPA Construction General Permit  
<http://cfpub.epa.gov/npdes/stormwater/cgp.cfm> , Latest revision or amendment;

#### 1.2 SUBMITTALS & DOCUMENTATION

The Contractor will submit or provide the following to the Owner:

- Construction Site Erosion Control Plan, if required. Contractor shall mark-up or create additional versions of the Erosion Control Plan that is included in these documents showing additional or alternate erosion control measures as needed due to the Contractors means and methods throughout all phases of construction.
- Submittals for materials used to implement the erosion control plan.

#### 1.3 EROSION CONTROL PLAN/SWP3

For project disturbing one acre of land or more:

The contractor shall provide a Stormwater Pollution Prevention Plan (SWP3) in accordance with Oklahoma Department of Environmental Quality and/or Environmental Protection Agency stormwater requirements. The contractor shall complete and submit any required documents, including but not limited to the Notice of Intent(NOI), Notice of Termination(NOT) to applicable agency having jurisdiction.

Contractor shall be responsible for insuring the completion of the SWP3 and compliance with the applicable General Permit.

Contractor shall comply with all the requirements of the erosion control plan, and the requirements of the General Permit to Discharge. Erosion control and storm water management practices shall be installed and maintained in accordance with the erosion control plan and General Permits.

Contractor shall provide all erosion control practices necessary to protect property and the environment. Erosion control and storm water management practices shall be installed and maintained in accordance with the erosion control plan and the applicable General Permit. The contractor shall update and modify the erosion control plan as needed for phasing of work. A copy of the current erosion control plan shall be maintained at the project site.

### 2.0 MATERIALS

#### 2.1 GENERAL

When the design or contract includes permanent erosion control or stormwater control features, the contractor may employ these items to control erosion and stormwater during construction activities. However, these features shall be fully cleaned and restored to the original design providing full function for the intended permanent use prior to acceptance of the work.

## 2.2 TEMPORARY SILT DIKES

Temporary silt dikes shall be triangular-shaped, having a height of at least eight to ten inches (8" - 10") in the center with equal sides and a sixteen- to twenty-inch (16" - 20") base. The triangular-shaped inner material shall be urethane foam. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle two to three (2' - 3') feet. Standard length of each dike will be seven feet (7') unless otherwise indicated on the plans. The dikes shall be attached to the ground with wire staples. The staples shall be No. 11 gauge wire and be at least six to eight (6" - 8") inches long. Staples shall be placed as indicated on the installation detail.

## 2.3 SILT SCREEN FENCE

Fabric shall be a woven polypropylene geotextile fabric

Silt screen fences shall be installed at least 6 feet from the right-of-way or property line, unless otherwise noted. Framework supports shall have a maximum spacing of 10 feet center to center, or as shown on the construction plans. Filter material shall be secured to the ground between supports to prevent the material from curling or rolling up. Silt screen fences may be removed or left in place as determined by the Engineer.

Silt screen fences shall be kept free from debris and sediment build up. Sediment removal shall be removed at the direction of the Engineer. Material removed shall be disposed of in a manner and location approved by the Engineer. After the sediment removal has been completed, the control devices shall be left in operable condition. Any damage to the control devices shall be replaced at the Contractor's expense.

## 2.4 EROSION MAT

Erosion mat shall consist of a machine produced wood excelsior mat with interlocking fibers that form a continuous web. Cover the mesh on one side with an extruded plastic netting with mesh size no greater than 1" x 2".

## 2.5 STAPLES

Permanent installations: Use biodegradable staples in accordance with manufacturer's recommendations for materials being anchored. Wood and metal staples are not allowed for permanent installations.

## 2.6 RIPRAP

Riprap shall be the class specified and shall conform to Oklahoma Department of Transportation Standard Specifications for Highway Construction Section 713, Type I Riprap. 12 inch stone size.

## 2.7 COMPOST FILTER SOCK

Compost filter sock is a biodegradable wood compost filled tube used to prevent erosion. Provide filter sock in accordance with AASHTO specification MP 9-06. Minimum 12 inch size.

## 2.8 TRACKING PAD STONE

The aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All material shall be retained on a 3-inch sieve.

## 2.9 SOIL STABILIZERS

Soil stabilizers shall be non-asphalt-based products of the type approved by Owner.

2.10 SOIL TACKIFIERS  
Soil tackifiers shall be non-asphalt-based products of the type approved by Owner.

2.11 POLYMERS  
Polymers used to settle suspended sediment shall meet the requirements of the WDNR Technical Standards.

### 3.0 EXECUTION

#### 3.1 GENERAL

Install and maintain erosion control measures as required by the erosion control plan throughout phases of the project. Notify Construction Representative of modifications to the erosion control plan as dictated by Contractor's means and methods, construction phasing or by differing site conditions.

Contractor shall provide all erosion control measures necessary to prevent and manage polluted runoff from the construction site and discharge of sediment onto adjacent property, into storm sewers or waters of the state.

Perform all work in accordance with manufacturer's instruction where these specifications do not specify a higher requirement.

#### 3.2 GRADING AND EARTHWORK

Install temporary or permanent erosion control measures applicable to each phase of grading or land disturbance prior commencing on that phase.

Clear only those areas designated for the placement of improvements or earthwork before placement of the final cover. Perform stripping of vegetation, grading, excavation, or other land disturbing activities in phases to minimizing exposure of bare soil. Do not clear the site of topsoil, trees, and other natural ground covers before the commencement of construction. Retain natural vegetation and protect until the final ground cover is placed.

Do not stockpile soil within 25 feet of any roadway, parking lot, paved area, or drainage structure or channel. Provide temporary stabilization and erosion control measures on disturbed areas and soil stockpiles which will remain for a period of more than 7 consecutive calendar days.

Remove surplus excavation materials from the site immediately after rough grading. The disposal site for the surplus excavation materials shall also be subject to these erosion control requirements.

#### 3.3 DRAINAGE

Divert roof drainage and runoff from all undisturbed areas upslope of the site around disturbed areas. Minimize runoff on exposed soil. Provide measures to remove sediment, and debris.

Convey clean or treated runoff to the nearest adequate stormwater facility. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving stormwater facility.

Protect storm sewer inlets and catch basins with inlet protection devices.

Provide ditch checks or silt dikes in swales or ditches to reduce the velocity of water in the channel.

Dewatering discharge shall be routed to a sedimentation basin or sedimentation vessel to reduce the discharge of sediments. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving stormwater facility.

#### 3.4 TRACKING CONTROL

Construct and maintain Tracking Pads in accordance with the Technical Standards. Provide each entrance to the site with a stone tracking pad at least 50 feet in length with a minimum thickness of 12 inches. The tracking pad shall be the full width of the egress point. Inspect tracking pads on a daily basis and replace aggregate when no longer effective.

If necessary, provide a crushed aggregate paved parking area.

If applicable, wash water shall be discharged to sedimentation basins, sedimentation vessels, or other such control areas. Untreated wash water shall not be routed to storm sewers or waters of the state.

#### 3.5 MAINTENANCE

Contractor shall inspect all erosion control measures within 24 hours of the end of each rainfall event that exceeds 0.25", or daily during periods of prolonged rainfall, or weekly during periods without rainfall. Immediately repair and/or replace any and all damaged, failed, or inadequate erosion control measures.

Re-apply soil stabilizers, tackifiers, polymers and anionic polyacrylamides as needed to prevent erosion of exposed soil.

Maintain records of all inspections and any remedial actions taken on-site.

Remove any sediment reaching a public or private roadway, parking lot, sidewalk, or other pavement. Do not remove tracked sediments by flushing. Completely remove any accumulations not requiring immediate attention at least once daily at the end of the workday.

Frequently dispose of all waste and unused construction materials in licensed solid waste or wastewater facilities. Do not bury, dump, or discharge, any garbage, debris, cleaning wastes, toxic materials, or hazardous materials on the site, on the land surface or in detention basins, or otherwise allow materials to be carried off the site by runoff onto adjacent lands or into receiving waters or storm sewer systems.



## SECTION 31 25 73 – TEMPORARY SILT FENCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings, Bidding Requirements, Contract Forms, Conditions of the Contract and Division 1 - General Requirements apply to the work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. This work shall consist of furnishing, installing, maintaining and removing a barrier-fence designed to remove suspended particles from the water passing through it. The quantities of temporary silt fence shown on the plans may be increased or decreased based on weather, construction procedures, and actual site conditions that occur during construction of the project. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.
- B. The contractor shall install a silt fence construction of geotextiles. Hay-bales may be substituted if approved by Engineer.

### PART 2 - PRODUCTS

#### 2.1 HAY BALES

- A. Rectangular, commercially sized bales, with densely packed hay, securely bound with wire or plastic strips.

#### 2.2 GEOTEXTILES

- A. This specification provides criteria for wire-supported geotextile silt fence as well as a self-supporting geotextile silt fence.
- B. Fibers used in the manufacture of geotextiles shall consist of long-chain synthetic polymers, composed of at least 85% by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such as that the filaments or yarns retain dimensional stability relative to each other, including selvages. The geotextile shall be specific for its intended purpose. The geotextile shall be free from any treatment or coating which might adversely alter its physical properties after installation.
- C. Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Each roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Rolls shall be stored in a manner which protects them from the elements.
- D. Posts: Either wood, steel or synthetic posts may be used. Posts shall have a minimum length of 36 in. plus burial depth and be of sufficient strength to resist damage during installation and to support applied loads.
- E. Support Fence: Wire or other support fences shall be at least 32 in. high and strong enough to support applied loads.
- F. Prefabricated Fence: Prefabricated fence systems may be used provided they meet all of the above material requirements.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

The Contractor shall install a temporary silt fence as shown on the plans, and at other locations as required. Fence construction shall be adequate to handle the stress from sediment loading.

- A. Hay-Bales: Shall be installed per the details shown on the plans.
- B. Geotextile Fence: Shall be installed per the details shown on the plans.
- C. It is the Contractor's responsibility to maintain the integrity of silt fences as long as they are necessary to contain sediment runoff. The Contractor shall inspect all temporary silt fences immediately after each rainfall and at least daily during prolonged rainfall. Any deficiencies shall be immediately corrected by the Contractor. In addition, the Contractor shall make a daily review of the location of the silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness. Where deficiencies exist, additional silt fences shall be installed. Should the silt fence become damaged or otherwise ineffective while the barrier is still necessary, it shall be repaired promptly.
- D. Sediment deposits shall either be removed when the deposit reaches approximately one-half of the height of the silt fence or a second silt fence shall be installed.
- E. The silt fence shall remain in place as long as needed. Upon removal, the Contractor shall remove and dispose of any excess silt accumulations, dress the area to give a pleasing appearance, and vegetate all bare areas. The fence materials will remain the property of the Contractor and may be used at other locations provided the materials meet their intended purpose.

END OF SECTION

## SECTION 31 41 34 - EXCAVATION, TRENCHING, & SHORING

### PART 1. GENERAL:

#### 1.1 DESCRIPTION:

- A. This section covers deep excavations and supporting systems for trenches to protect the safety of workers, provide suitable means for constructing sewer lines, and to protect public or private property, including existing utilities.
- B. Detailed designs for proposed shoring, etc. shall be submitted and designed by a registered professional engineer employed by the contractor for the architects review prior to starting work. The Owner, Architect, Architect's consultants and their agents and employees do not in any way assume responsibility for the shoring design to be utilized by the Contractor. Contractor shall assume the entire responsibility for all shoring, etc. and make good any damage caused by or due to improper supports or failure of shoring, etc. in any respect.

#### 1.2 EXISTING STRUCTURES:

- A. Where existing buildings, other utilities, streets, highways, or other structures are in close proximity to the trench, adequate protection shall be provided by the use of sheeting and shoring to protect the structure, street, or highway from possible damage. In the case of utilities, the Contractor may elect to remove the utility provided that the removal and subsequent replacement meets with the approval of the Architect, Engineer, the utility owner, or whoever has jurisdiction of the structure. In all cases, it shall be the responsibility of the Contractor to protect public and private property and any person or persons who might, as a result of the Contractor's work, be injured.

### PART 2. EXECUTION

#### 2.1 EXCAVATIONS, TRENCHING, AND SHORING:

- A. The Contractor shall include in his bid price and be solely responsible for trench safety provisions meeting the requirements of the United States Department of Labor Occupational Safety and Health Administration. The Contractor shall, as a minimum, provide trench safety provisions as shown on the plans and conforming to the following regulations, as contained in Subpart P, Part 1926 of the Code of Federal Regulations, shall be complied with along with all other applicable Subparts and Regulations not herein contained:
  - 1. Subpart P - Excavations, Trenching, and Shoring:
    - a. General Protection Requirements:
      - 1) Walkways, runways, and sidewalks shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of one hundred and twenty- five (125) pounds per square foot.
      - 2) If planks are used for raised walkways, runways, or sidewalks, they shall be laid parallel to the length of the walk and fastened together against displacement.
      - 3) Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.
      - 4) Raised walkways, runways, and sidewalks shall be provided with plank steps on strong stringers. Ramps, used in lieu of steps, shall be provided with cleats to insure a safe walking surface.
      - 5) All employees shall be protected with personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet and other parts of the body as set forth in Subpart E. of this part.

- 6) Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with and made of reflectorized or high-visibility material.
- 7) Employees subjected to hazardous dusts, gases, fumes, mists or atmospheres deficient in oxygen, shall be protected with approved respiratory protection as set forth in Subpart D of this part.
- 8) No person shall be permitted under loads handled by power shovels, derricks, or hoists. To avoid any spillage employees shall be required to stand away from any vehicle being loaded.
- 9) Daily inspections of excavations shall be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees.

b. Specific Excavation Requirements:

- 1) Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., sewer, telephone, water, fuel, electric lines, etc. will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact locations shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.
- 2) Trees, boulders and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operation shall be removed or made safe before excavating is begun.
- 3) The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.
- 4) Excavations shall be inspected by a competent person after every rainstorm or other hazard-increasing occurrence and the protection against slides and cave-ins shall be increased if necessary.
- 5) The determination of the angle of repose and design of the supporting system shall be based on careful evaluation of pertinent factors such as: Depth of cut, possible variation in water content of the material while the excavation is open; anticipated changes in materials from exposure to air, sun, water, or freezing; loading imposed by structured, equipment overlying material, or stored material; and vibration from equipment, blasting, traffic, or other sources.
- 6) Supporting systems, i.e., piling, cribbing, shoring, etc. shall be designed by a qualified person and meet accepted engineering requirements. When tie rods are used to restrain the taping, sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose. When tight sheeting or sheet piling is used, full loading due to ground water table shall be assumed, unless preventing by weep holes or drains or other means. Additional stringers, ties and bracing shall be provided to allow for any necessary temporary removal of individual supports.
- 7) All slopes shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.
- 8) The angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
  - a) In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.
  - b) As an alternative to the clearance prescribed in sub-paragraph (1) of this paragraph, the employer may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the excavation.

- 9) Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.
- 10) Support systems shall be planned and designed by a qualified person when excavation is in excess of 20 feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.
- 11) Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots, and of proper dimensions.
- 12) Special precautions shall be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Particular attention also shall be paid to joints and seams of materials comprising a face and the slope of such seams and joints.
- 13) Except in hard rock, excavation below the level of the base of footing of any foundation or retaining wall shall not be permitted, unless the wall is underpinned and all other precautions taken to insure the stability of the adjacent walls for the protection of employees involved in excavation work or in the vicinity thereof.
- 14) If the stability of adjoining buildings or walls is endangered by excavations, shoring, bracing, or underpinning shall be provided as necessary to insure their safety. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent person and the protection effectively maintained.
- 15) Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.
- 16) If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the sides of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.
- 17) Blasting and the use of explosives shall be performed in accordance with Subpart U of this part.
- 18) When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.
- 19) Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits shafts, etc. shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc. shall be backfilled.
- 20) If possible, dust conditions shall be kept to a minimum by the use of water, salt, calcium chloride, oil or other means.
- 21) In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls as set forth in Subpart d, D and E of this part, shall be established to assure acceptable atmospheric conditions. When flammable gases are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, basket stretcher, etc. shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.
- 22) Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided.
- 23) Where ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.
- 24) All ladders used on excavation operations shall be in accordance with the requirements of Subpart L of this part.

c. Specific Trenching Requirements:

- 1) Banks more than 5 feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to Table P-1 as a guide in sloping of banks. Trenches less than 5 feet in depth shall also be effectively protected when examination of ground indicates hazardous ground movement may be expected.
- 2) Sides of trenches in unstable or soft material, 5 feet or more in depth, shall be shored, sheeted, braced, sloped or otherwise supported by means of sufficient strength to protect the employees working within them. See Tables P-1, P-2 (following paragraph (1) of this section).
- 3) Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5 feet in depth and 8 feet or more in length. In lieu of shoring, the sides of the trench above the 5 foot level may be sloped to preclude collapse, but shall not be steeper than a 1 foot rise to each 1/2 foot horizontal. When the outside diameter of a pipe is greater than 6 feet, a bench of 4 foot minimum shall be provided at the toe of the sloped portion.
- 4) Materials used for sheeting and sheet piling, bracing, shoring, and underpinning, shall be in good serviceable condition and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the excavation.
- 5) Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.
- 6) Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier hole which is above the bell. A lifeline, suitable for instant rescue and securely fastened to a shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.
  - a) Minimum requirements for trench timbering shall be in accordance with Table P-2.
  - b) Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of values given by the following formula:

$$S = 1300 - \frac{20L}{D}$$

$$\text{Maximum ratio } \frac{L}{D} = 50$$

Where:

L = Length, unsupported, in inches.

D = Least side of the timber in inches.

S = Allowable stress in pounds per square inch of cross-section.

- 7) When employees are required to be in trenches 4 feet deep or more, an adequate means of exit, such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel.
- 8) Bracing or shoring of trenches shall be carried along with the excavation.
- 9) Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling or kickouts.
- 10) Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench.

- 11) Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

TABLE P-1

<u>Soil Type</u>	<u>Approximate Angle of Repose for Slope of Sides of Excavations</u>
Solid Rock, Shales or Cemented Sand and Gravel	90 degrees
Compacted Angular Gravels	63 degrees 26' (1/2:1)
Recommended Slope for Average Soils	45 degrees (1:1)
Compacted Sharp Sand	33 degrees 41' (1-1/2:1)
Well Rounded Loose Sand	26 degrees 34' (2:1)

NOTE: Clays, silts, loams or non-homogenous soils require shoring and bracing. The presence of ground water required special treatment.

d. Definitions Applicable To This Subject:

- 1) "Accepted Engineering Requirements (or practices)" - Those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognizable authority.
- 2) "Angle of Repose" - The greatest angle above the horizontal plane at which a material will lie without sliding.
- 3) "Bank" - A mass or soil rising above a digging level.
- 4) "Belled Excavation" - A part of a shaft or footing excavation usually near the bottom and bell-shaped; i.e., an enlargement of the cross section above.
- 5) "Braces (trench)" - The horizontal members of the shoring system whose ends bear against the upright or stringers.
- 6) "Excavation" - Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.
- 7) "Faces" - See paragraph "k." of this section.
- 8) "Hard Compact Soil" - All earth materials not classified as running or unstable.
- 9) "Kick-outs" - Accidental release or failure of shore or brace.
- 10) "Sheet pile" - A pile, or sheeting, that may form one of a continuous interlocking line, or a row of timber, concrete or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.
- 11) "Sides", "Walls", or "Faces" - The vertical or inclined earth surfaces formed as a result of excavation work.
- 12) "Slope" - The angle with the horizontal at which a particular earth material will stand indefinitely without movement.
- 13) "Stringers" (wales) - The horizontal members of a shoring system whose sides bear against the uprights or earth.
- 14) "Trench" - A narrow excavation made below the surface of the ground. In general, the depth is greater than the width but the width of a trench is not greater than 15 feet. o.  
"Trench Jack" - Screw or hydraulic type jacks used as cross bracing in a trench shoring system.

- 15) "Trench Shield" - A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.
- 16) "Unstable Soil" - Earth material, other than running, that because of its nature or the influence of related conditions cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.
- 17) "Uprights" - The vertical members of a shoring system.
- 18) "Wales" - See paragraph "m." of this section.
- 19) "Walls" - See paragraph "k." of this section.

*Additional information may be obtained from the U.S. Department of Labor Occupational Safety and Health Administration (OSHA), 525 Griffin Square Building, Room 602, Dallas, Texas 75202, (214) 767-4731.*

B. Trench Box:

1. Contractor may purpose, as an alternate, the use of a sliding or moveable trench box instead of trench shoring.
2. Contractor shall submit details and full design data for the trench box to the Engineer for review and approval.

C. Government Agency Approval:

1. Contractor shall submit trench safety design to the appropriate government agencies for approval in accordance with current requirements.

END OF SECTION