# Kirkland Heights Apartments
# Building 8 Renovation

13321 NE 133rd St.
Kirkland, WA 98034

Contract No. AM2200131

## Project Manual
## Volume 2:
## Divisions 03, 05-12, 21-23, 26-28, 31-33

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600 Andover Park W
Tukwila, WA 98188

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# SECTION 03 01 00

# MAINTENANCE OF CONCRETE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes concrete surfaces, cracks, and reinforcement repair, or replacement, for existing walls, sidewalks and curbs at the perimeter of this Work damaged during the work of this Contract.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Related Sections:
   1. Section 03 30 00 – Cast-In-Place Concrete.
   2. Section 05 05 23 – Welding.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
   4. ASTM C33 - Standard Specification for Concrete Aggregates.
   5. ASTM C109/C109M - Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-in. or (50 mm) Cube Specimens).
   6. ASTM C150 - Standard Specification for Portland Cement.
   7. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   8. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).
   9. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
   10. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
   11. ASTM C1042 - Standard Test Method for Bond Strength of Latex Systems Used With Concrete By Slant Shear.
   12. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
   13. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
   14. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. American Welding Society: AWS D1.4 - Structural Welding Code - Reinforcing Steel.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Samples: Submit color samples for patches required to match existing.

D. Submit mix designs for each separate application.

E. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Accurately record actual locations of concrete repairs or replacements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with City of Kirkland standards.

B. Maintain one copy of documents on site.

C. Perform welding work in accordance with AWS D1.4. Any welding must be performed by WABO certified welders conforming to Section 05 05 23.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in concrete repair with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with instructions for storage, shelf life limitations, and handling.

PART 2 PRODUCTS

2.1 EPOXY ADHESIVE INJECTION MATERIALS

A. Furnish materials in accordance with City of Kirkland standards.

B. Epoxy Adhesive: Two-part epoxy adhesive containing 100 percent solids, meeting the following minimum characteristics or those of City of SeaTac Standards, whichever is greater:

| Characteristic | Test Method | Results |
|---|---|---|
| Bond Strength | ASTM C882 | 2,700 psi |
| Tensile Strength | ASTM D638 | 6,600 psi |
| Elongation | ASTM D638 | 2 percent at 7 days, 70 degrees F |
| Flexural Strength | ASTM D790 | 8,000 psi |
| Compressive Strength | ASTM D695 | 6,500 psi |

2.2 CONCRETE MATERIALS

A. Refer to Section 03 30 00 Cast-In-Place Concrete.

2.3 REINFORCEMENT MATERIALS

A. Refer to Section 03 20 00 Concrete Reinforcement. Match existing reinforcement size, strength, spacing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

C. Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using water; rinse surface and allow to dry.

B. Remove concrete slab or curb entirely back to the nearest expansion joint. Removal of damaged concrete to the nearest crack control joint will not be approved.

C. Clean exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

D. Compact substrate soils to match density of existing soils prior to damage.

3.3 REPAIR AND REPLACEMENT WORK

A. Any repair of reinforcing shall be coordinated with, and approved by, the jurisdiction or permitting authority in addition to the Engineer of Record.

B. Repair reinforcement by welding new bar reinforcement to existing reinforcement with sleeve splices. Strength of welded splices and reinforcement to exceed original stress values.

C. Replace damaged work to match existing in material, thickness, shape, color and finish.

D. Replace expansion joint material as needed, matching material and color of existing joint materials.

E. Sack and patch concrete walls to repair air pockets, honeycombing, blow holes and other surface imperfections to achieve a smooth finish.

3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Inspect reinforcement steel placement prior to casting concrete.

C. Test concrete for compressive strength during pours.

END OF SECTION

# SECTION 03 10 00

# CONCRETE FORMING AND ACCESSORIES

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes: Formwork for cast-in place concrete, forming accessories, step nosings, form stripping.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Related Sections:
1. Section 03 20 00 – Concrete Reinforcing.
2. Section 03 30 00 – Cast-In-Place Concrete.
3. Section 05 50 00 – Metal Fabrications.
4. Section 32 16 00 – Curbs and Sidewalk.

### 1.2 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association: AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association: APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. American Society of Mechanical Engineers: ASME A17.1 - Safety Code for Elevators and Escalators.

E. ASTM International:
1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. West Coast Lumber Inspection Bureau: WCLIB - Standard Grading Rules for West Coast Lumber.

### 1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

B. Provide Class 'A' for all exterior and interior exposed (painted and non-painted) concrete surfaces.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on form materials and form release products.

C. VOC limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

D. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, ACI 301, and ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Design formwork under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Washington.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, metal, fixed length, cone type, with waterproofing washer, free of defects capable of leaving holes larger than 1-1/4 inch in concrete surface. Note that form tie holes will be exposed to view in the finished work. Refer to Section 03 30 00.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers in exposed concrete leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.

3. Penetration of structural steel members is not permitted.

D. Form Release Agent:
1. Shall be delivered in manufacturer's sealed and trademarked containers and shall be guaranteed to provide clean, stain-free concrete release and not to interfere with future-applied coatings and finishes.
2. Vegetable-based: paraffin and waxes shall not be used when a concrete finish is specified.
3. Waterborne: Low VOC.
4. Manufacturers:
a. Conspec Marketing and Manufacturing Co. Inc., Enviroform and Aquastrip.
b. Cresset Chemical Co., Crete-Lease 20-VOC.
c. Franmar Chemical Inc., Asphalt Release.
d. Leahy-Wolf Company, Bio-Form.
e. M.J. Doud, Inc., Greenplus Form Release Agent ES.
f. Natural Soy, LLC, Soy Form Away.
g. Tamms Industries, Aquaform.
h. W.R. Meadows, Inc., SealTight Dougard II.
i. Substitutions: Section 01 25 13 – Product Substitution Procedures.

E. Corners: Chamfer, rigid plastic or wood strip type; size per drawing details; maximum possible lengths.

F. Flashing Reglets: The products of the Fry Reglet Corporation, or approved equal, as detailed on the drawings, longest possible lengths, with alignment splines for joints.

G. Vapor Barrier: under slabs on grade, refer to Section 07 26 00 Vapor Barriers and Vapor Retarders.

H. Bituminous Joint Filler: ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

J. Accent Joints: rigid plastic or wood strip type; horizontal or vertical orientation, refer to drawings for locations and detail.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms: Earth forms are not permitted.

B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:
1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with reference standards.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

I. Install chamfer strips on external corners.

J. Install void forms in accordance with manufacturer's recommendations.

K. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals specified in Section 04 20 19 Veneer Unit Masonry or as indicated on Drawings.

E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings. Note that form holes will be left exposed to view. Refer to Section 03 30 00.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane will not be permitted.

O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean form cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

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

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI reference standards.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Inspection Company after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

3.9 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations where feasible.

B. Give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 03 20 00

# CONCRETE REINFORCING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes reinforcing bars, welded wire fabric, fibrous reinforcement, and reinforcement accessories.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the metals.

E. Related Sections:
1. Section 03 10 00 – Concrete Forming and Accessories.
2. Section 03 30 00 – Cast-In-Place Concrete.
3. Section 05 05 23 – Welding
4. Drawing sheets that include General Structural Notes.

### 1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A185-06 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
8. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

9. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
10. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
11. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
12. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
13. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
14. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
15. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society: AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

## 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices. Submit wall elevations indicating locations of embedded elements including embed plates, etc.

C. Product literature: Fibrous concrete reinforcement products.

D. Certificates: Submit AWS qualification certificate for welders employed on the Work.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements. Submit certified copies of mill test report of reinforcement materials analysis.

F. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

G. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

H. Provide certification from manufacturer verifying the location of the fabricator for products of this Section. Include mailing address and phone number. Provide list of recovered or recycled steel within 500 miles of project site.

## 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, and ACI 318. In the event of conflict, notify the Architect.

B. Prepare shop drawings in accordance with ACI SP-66.

C. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months. Welding to be performed by WABO Certified welders conforming to Section 05 05 23.

B. No reinforcing may be welded except where noted.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. All products: Refer to the General Structural Notes on the drawings.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions, including load bearing pad on bottom to prevent vapor barrier puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape to meet Project conditions.

D. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318-14.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrup and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form ties and stirrups from the following:
   1. For bars #6 and Smaller: #3 deformed bars.
   2. For bars #7 and Larger: #4 deformed bars.

F. Weld reinforcement in accordance with AWS D1.4. No reinforcement may be welded except where noted.

G. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

## PART 3 EXECUTION

### 3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.

B. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 of one bar diameter, but not less than 1 inch. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

F. Splice reinforcing in accordance with splicing device manufacturer's instructions. Splicing device specifications must be submitted to Engineer of Record for approval prior to installation.

### 3.2 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

| Reinforcement Depth | Depth Tolerance | Concrete Cover Tolerance |
|---|---|---|
| Greater than 8 inches | plus or minus 3/8 inch | minus 3/8 inch |
| Less than 8 inches | plus or minus 1/2 inch | minus 1/2 inch |

### 3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318 and the Building Code.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
   1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
   2. Welding Inspection Procedures and Acceptance: AWS D1.1.
   3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
   4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
   5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
   6. Periodic Weld Inspection: Other welded connections.

3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 03 30 00

# CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes cast-in-place concrete and concrete finishing for the following:
   1. Footings.
   2. Foundation walls.
   3. Retaining walls.
   4. Slabs on grade.
   5. Control, expansion and contraction joint devices.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
   1. Section 03 01 00 – Maintenance of Concrete (existing sidewalks and curbs).
   2. Section 03 10 00 – Concrete Forming.
   3. Section 03 20 00 – Concrete Reinforcing.
   4. Section 07 90 00 – Joint Protection.
   5. Section 09 90 00 – Painting and Coating.
   6. Division 26: Electrical items for casting into concrete.
   7. Division 32: Exterior Improvements.
   8. Section 32 16 00 – Curbs and Sidewalks.
   9. Drawings sheets that include General Structural Notes.

### 1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 302.1 – Guide for Concrete Floor and Slab Construction.
   3. ACI 303R – Guide to Cast-in-Place Architectural Concrete.
   4. ACI 305 - Hot Weather Concreting.
   5. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   6. ACI 308.1 - Standard Specification for Curing Concrete.
   7. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
9. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
10. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
13. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
15. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
16. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
17. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
18. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
19. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
20. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
21. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
22. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
23. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
24. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
25. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
26. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
27. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
28. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

29. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
30. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
31. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
32. ASTM E1155 – Standard Test Method for Determining Floor Flatness and of Levelness Using the F-Numbering System.
33. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories, admixtures.

C. Design Data:
   1. Submit concrete mix design for each concrete mix to be used identifying where it will be used. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

E. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301, ACI 303R, and ACI 318.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I or Type II. Type III cement may be used for cold weather construction.

B. Normal Weight Aggregates: ASTM C33. Aggregates shall be free from any substance that may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete. Maximum ½" aggregate for all concrete walls.

C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Refer to the General Structural Notes: The use of admixtures is the responsibility of the Contractor, and only as approved by the Structural Engineer.

B. Air Entrainment: ASTM C260. Master Builders "Micro-Air", Grace "Daravair", Sike "AEA-15", or approved equal.

C. Fly Ash: ASTM C618 Class F, maximum 30% by weight of all cementitious materials. Use fly ash from one single source for the entire project. Slag is not an acceptable alternate to fly ash.

2.3 ACCESSORIES

A. Bonding Grout and repair materials: Use products in accordance with manufacturer's printed instructions.

1. Manufacturers:

a. Portland Cement mortar modified with a latex acrylic, non-re-emulsified bonding agent conforming to ASTM C1059 Type II. Acceptable products include Euclid Chemical Co. "Flex-Con", Dayton "Day-Chem Ad Bond (J-40)".

b. Epoxy mortars and epoxy compounds that are moisture insensitive during application and after curing and that embody an epoxy binder conforming to ASTM C881.

c. Shrinkage-compensating or non-shrink Portland Cement grout conforming to ASTM C1107. Acceptable products include Master Builders "Masterflow 713 Grout", Dayton "Sure-Grip High Performance Grout", Burke "Non-Ferrous Non-Shrink Grout", or approved equal.

d. Packaged, dry concrete repair materials conforming to ASTM C928. Acceptable products include Master Builders "Emaco T415", Dayton "HD-50", Burke "Fast Patch 928", or approved equal.
e. Substitutions: Section 01 25 13 – Product Substitution Procedures.

B. Dissipating Resin Curing Materials: liquid type membrane forming curing compound complying with ASTM C309, Type I. Curing compound must be of a type that does not inhibit subsequent moist curing operations. The film shall chemically break down in a two-to-four-week period and shall not affect adhesion of coverings or membranes. Acceptable products are Burke "RES-X Curing Compound", Euclid Chemical Co "Kurez DR", Dayton "Day-Chem Rez Cure (J-11-W)", or approved equal.

C. Moisture retaining cover: waterproof sheet materials conforming to ASTM C171.

D. Concrete Reinforcing Fibers: ASTM C1116, refer to the General Structural Notes on the drawings.

E. Pre-formed Waterstops: Rubber, neoprene, or PVC products of Greenstreak, JP Specialties, Inc., Paul Murphy Plastics Co. (Wirestop), or approved equal. Supply and install together with the manufacturer's pre-molded unions and fittings for splices, directional changes, and intersections.

F. Bentonite Waterstops: The products of Cetco, Volclay Waterstop-RX, expanding concrete joint waterstop, together with manufacturer's primer and adhesive.

## 2.4 CONCRETE MIX

A. For concrete slabs where flooring finishes using adhesives are scheduled on the drawings, the maximum water/cement ratio shall not exceed 0.42 – 0.40.

B. Select proportions for normal weight concrete in accordance with ACI 301. Prepare mix designs for each type and strength of concrete. Concrete strength is to be verified by submitting test data in accordance with ACI 318 Section 5.3 by Field Experience Method or, if available, by Laboratory Trial Batch Methods. Mix proportions shall produce consistent and workable concrete that can be worked readily into forms and around reinforcement without segregation or excessive bleeding.

1. Field Experience Method: if Field test data is available, in accordance with ACI 301, submit for acceptance the mixture proportions along with the field test data.
2. Trial Batch Method: Use an independent, qualified testing facility for preparing and reporting proposed mix designs. All expenses connected with such testing and submittals shall be borne by the Contractor.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 and ACI 318.

B. Notify testing laboratory minimum 24 hours prior to commencement of pouring operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and vapor barrier sheet are not disturbed during concrete placement.

D. Install vapor barrier under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight using products and procedures recommended by the sheet manufacturer.

E. Repair vapor barrier damaged during placement of concrete reinforcing, following manufacturer's recommended procedures.

F. Separate slabs on grade from vertical surfaces with ½" inch thick joint filler.

G. Install construction joints and crack control joints after review with Architect. Set top to required elevations. Secure to resist movement by wet concrete.

H. Deposit concrete at final position. Prevent segregation of mix.

I. Place concrete in continuous operation for each panel or section determined by predetermined joints.

J. Consolidate concrete.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

L. Place concrete continuously between predetermined expansion, control, and construction joints.

M. Saw cut control joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

N. Screed slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft. Slope to drains as indicated, and slope to drain away from the building.

O. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/4 inch per foot nominal, or as otherwise indicated on drawings.

## 3.4 CONCRETE FINISHING

A. Provide formed concrete walls with smooth formed finish. Form tie holes shall be expressed in the finished work; remove ties and fill holes neatly flush with surface.

B. Light broom finish on all exterior concrete slabs on grade.

C. Provide Class 'A' per ACI 347 for all concrete surfaces (painted and non-painted) exposed to view at building interior and exterior.

D. Provide Class 'B' per ACI 347 for all non-exposed concrete surfaces.

E. Finish concrete floor surfaces in accordance with ACI 301 and ACI 318.
   1. Screed to true levels and slopes.
   2. Tool all salient edges of concrete.
   3. Machine troweling permitted provided that maximum specified tolerance is not exceeded.
   4. Do not absorb water with neat cement.
   5. Make sharp arise at wall-to-floor conditions.
   6. Perform scoring indicated and/or specified. Maintain all control, construction, and expansion joints.

F. Edge forms and screeds. Set edge forms and intermediate screed strips accurately to produce designed elevations and contours in finished surfaces. Build sufficiently strong to support vibrating bridge screeds or roller type screeds if required for specified finish. Align concrete surface to contours of screed strips by use of strike-off templates or reviewed compacting type screeds. All concrete requiring finishing to be protected from rain or snow during finishing operations.

G. Slab tolerance:
   1. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E1155 and ACI 302.1R (paragraph 8.15) for a randomly trafficked floor surface:
      a. All floors other than those to receive thin-set flooring or resilient floor covering: Specified overall values of flatness, F(F)25, and levelness F(L)20; with minimum local values of flatness F(F)17, and levelness F(L)15.
      b. Thin-set flooring, resilient floor covering: Specified overall values of flatness, F(F)35, and levelness F(L) 25; with minimum local values of flatness F(F)24, and levelness F(L)17.
      c. If floors exceed these values, Contractor shall be responsible for any corrections. For elevated slabs on metal deck, conform only to flatness criteria above; levelness criteria above do not apply.
   2. In mechanical spaces with equipment floor drains, maintain floor level and pitch to drains in a 12-inch radius.
   3. In rooms shown with floor areas sloping to drain, provide slope true to line and evenly graded.

H. Finishes:
   1. Float finish: Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes specified, and slab surfaces shown or scheduled for waterproofing and roofing.
   2. Scratch finish: Apply scratch finish to monolithic slab surfaces that are to receive mortar setting beds for pavers.

3. Steel trowel finish those surfaces scheduled for carpeting, resilient flooring, and seamless flooring. Steel trowel those surfaces scheduled to be exposed, with no finish, and/or polished or bead-blasted finish.
   a. Screed accurately to proper elevations without irregularities. Allow concrete time to bleed naturally before working. Float to compact plastic mass using motor driven metal disc type float. Do not overwork. Finish with a steel trowel, performing final troweling after surface is hard enough to ring under the trowel.
   b. Retain moisture in slab surface during finishing. Provide a fog spray over finish area in dry or windy weather. Have on hand a hose and spray nozzle.
   c. Conform to surface flatness slab tolerance as noted above. Take special care to finish slab level and true with the main area of the slab around conduit, plumbing stacks, and the like. Use of dry cement to remove free water is prohibited.
   d. Use trowel finish for all concrete surfaces not receiving a broomed or other specified finish, unless noted otherwise.
4. Broom finish: provide on all exterior concrete walking surfaces. Float finish and then score with a broom to produce a uniform texture perpendicular to the direction of traffic.

I. Floors to receive grind & polish where indicated on drawings (Section 03 40 00):
   1. Smooth finish from edge to edge with no rough areas.
   2. Concrete curing: minimum twenty-eight days
   3. Floor Flatness: (FF) of 35.
   4. Floor Levelness: (FL) of 25.
   5. Sheen Level: Semi-gloss finish.

J. Defective work: Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

K. Promptly remove and replace, when directed to do so, slabs that show excessive shrinkage cracks, and any slabs that do not drain properly.

## 3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure concrete in accordance with ACI 308.1. Cure floor surfaces in accordance with ACI 301.

## 3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner’s testing laboratory in accordance with ACI 318, the 2015 IBC, and the permitting authority.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to Structural Engineer for review prior to commencement of Work.

E. Concrete Inspections:
   1. Reinforcing steel placement prior to concrete pours.
   2. Continuous Placement Inspection: Inspect for proper installation procedures.
   3. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of five cylinders for every150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
   4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
   5. Make one additional cylinder during cold weather concreting, and field cure.

G. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M or ASTM C231.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39.
   2. Test Acceptance: In accordance with ACI 318.
   3. Test one cylinder at 7 days.
   4. Test two cylinders at 28 days.
   5. Retain two cylinders for 56 days, or as otherwise requested by Architect/Engineer.
   6. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42/C42M.
   2. Test Acceptance: In accordance with ACI 318.
   3. As directed by Architect/Engineer, drill cores for each failed strength test from concrete represented by failed strength test.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

## 3.7 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections as directed by Architect/Engineer, and in accordance with ACI 301.

## 3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

## 3.9 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 05 05 23

# WELDING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes welding of structural and miscellaneous metals specified in other Sections.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

D. Related Sections:
1. Section 05 12 00 – Structural Steel Framing.
2. Section 05 50 00 – Metal Fabrications.
3. General Structural Notes on the drawings.

### 1.2 REFERENCES

A. American Institute of Steel Construction, AISC, Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings, latest edition.

B. ASTM International:
ASTM A706-06a – Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

C. American Welding Society (AWS):
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
1. AWS Structural Welding Code, AWS D1.1-2006.
2. AWS Structural Welding Code – Sheet Steel, AWS D1.3-2007.
3. AWS Reinforcing Steel Welding Code. AWS D1.4-2005.
4. AWS Recommended Practices for Resistance Welding, AWS C1.1-2006.

1.5 QUALIFICATIONS

A. Welding Certification: All welding performed by Certified Welders, certified within previous 12 months by Washington Association of Building Officials (WABO). Submit evidence of certification for the type of welding performed.

B. Contractor must have valid local Fire Department Cutting and Welding permit.

1.6 COORDINATION

Section 01 30 00 - Administrative Requirements: Requirements for coordination.

PART 2 PRODUCTS

2.1 MATERIALS

See individual referenced Sections for metals to be welded.

2.2 WELDING MATERIALS

Electrodes: Type 70XX (refer to the General Structural Notes on the drawings), or as otherwise required to develop strength of particular grade and section to be welded in accordance with AWS recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Verify anchors are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Shape edges to be joined as necessary to accomplish a sound weld and as indicated on the drawings. Prepare and clean edges of all oil, grease, scale and rust in accordance with AWS D1.1. Remove paint and galvanizing from surfaces prior to welding.

B. Protection: Take all precautions required by regulations and referenced standards to protect persons and property. Carefully mask or shield all adjacent surfaces to prevent damage from heat or welding materials. Take particular care to prevent fires, and provide fire extinguisher nearby. When welding finished assemblies adjacent to, or above, finished materials protect surfaces from damage related to welding activities.

3.3 WELDING PROCEDURES

A. Clean and weld in accordance with referenced AISC Specifications Section 1.17, and AWS D1.1, D1.3, and D1.4.

B. Miscellaneous and Reinforcing Steel: See structural drawings for welding of reinforcing bars or plates, angles, and similar shapes. Conform to referenced regulatory requirements AWS D1.1 and D1.4.

C. Use automatic end welding according to AWS D1.1 and manufacturer's written instructions to develop full capacities of shear stud connectors, threaded studs or deformed bar anchors.

D. Use electrodes type in accordance with the structural drawings and with referenced AWS standards. Electrodes to be thoroughly dry prior to use.

E. Grind smooth all welds exposed to view, except fillet welds. Provide reasonably smooth and uniform as-weld surfaces for fillet welds exposed to view. Remove all service metal and piece marks on steel items exposed to view. Paint all welds to be exposed in the finished work with primer specified in Section 05 12 00.

## 3.4 CLEANING AND REPAIR

A. Remove all slag or flux remaining on any bead.

B. Remove any cracks or blowholes appearing on any bead. Use Methods such as chipping, grinding, or gas gouging.

C. Repair any damaged finishes as directed, or replace damaged items at no additional cost to the Owner.

D. Clean welding area daily.

## 3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting and testing.

B. Welding:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Visually inspect all welds.
3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.

C. Correct defective bolted connections and welds.

## 3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 05 12 00

# STRUCTURAL STEEL FRAMING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes structural shapes, channels and angles, tubes and pipe, plates and bars, fasteners, connectors, and anchors, and grout.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete.
2. Section 05 05 23 – Welding.
3. General Structural Notes on the drawings.

### 1.2 REFERENCES

A. American Institute of Steel Construction:
1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
3. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
4. AISC Seismic Provisions for Structural Steel Buildings.
5. AISC Specification for Design of Single-Angle Members.
6. AISC Specification for the Design of Steel Hollow Structural Sections.
7. AISC Specification for Structural Steel Buildings.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
8. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
10. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
11. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
15. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
16. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
19. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
20. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
21. ASTM A847 - Standard Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.
22. ASTM A852/A852M - Standard Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick.
23. ASTM A913/A913M - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
24. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
25. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
26. ASTM E94 - Standard Guide for Radiographic Examination.
27. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments.
28. ASTM E165 - Standard Test Method for Liquid Penetrant Examination.
29. ASTM E709 - Standard Guide for Magnetic Particle Examination.
30. ASTM F436 - Standard Specification for Hardened Steel Washers.
31. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
32. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

33. ASTM F1852 - Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.

D. Research Council on Structural Connections: RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.

E. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 15 - Steel Joist Shop Paint.
3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
4. SSPC SP 3 - Power Tool Cleaning.
5. SSPC SP 6 - Commercial Blast Cleaning.
6. SSPC SP 10 - Near-White Blast Cleaning.

## 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, connections and fasteners.
2. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

D. Manufacturer's Mill Certificate: Certify products meet or exceed specified requirements.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

F. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

G. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

H. Provide manufacturer's literature certifying that steel products contain a minimum of 18% recycled scrap content. Identify post-consumer and post-industrial percentages.

I. Provide certification from manufacturer verifying the location of the fabricator for products of this Section. Include mailing address and phone number. Provide list of recovered or recycled steel within 500 miles of project site.

## 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. AISC Code of Standard Practice for Steel Buildings and Bridges.

2. AISC Code of Standard Practice for Steel Buildings and Bridges. Section 10.
3. AISC Seismic Provisions for Structural Steel Buildings.
4. AISC Specification for Structural Steel Buildings AISC Specification for the Design of Steel Hollow Structural Sections.
5. AISC Specification for Design of Single-Angle Members.
6. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum 5 years experience.

B. Erector: Company specializing in performing Work of this section with minimum 5 years experience.

C. Shop Painter: Company specializing in performing Work of this section with minimum 5 years experience.

D. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

Structural Shapes, bars, plates: according to the General Structural Notes on the drawings.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

Bolts, nuts, washers, and connectors: according to the General Structural Notes on the Drawings.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

B. Refer to Section 05 05 23.

2.4 ACCESSORIES

A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength as indicated in the General Structural Notes on the drawings.

B. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

2.5 FABRICATION

A. Space shear stud connectors at spacing indicated on the Drawings.

B. Continuously seal joined members as indicated on the drawings. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.6 FINISH

A. Prepare structural component surfaces in accordance with referenced standards.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Verify anchors are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchors and embedments in concrete work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components and shear connectors indicated on Drawings.

C. Field connect members with threaded fasteners; torque to required resistance.

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Grout under base plates and as otherwise shown in accordance with Structural Notes.

B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.

C. Moist cure grout.

D. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Refer to AISC Code of Standard Practice for Steel Buildings and Bridges.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting and testing.

B. Bolted Connections: Inspect in accordance with AISC specifications.
   1. Visually inspect all bolted connections.
   2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.

C. Welding:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Visually inspect all welds.
   3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.

D. Correct defective bolted connections and welds.

3.7 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items as indicated on the drawings: structural supports for miscellaneous attachments, handrails, guardrails, fences, gates, gratings and the like.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials. Refer to Section 01 81 15 & 01 81 19 for specific requirements.

D. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 05 12 00 – Structural Steel
3. Section 05 05 23 – Welding.
4. Section 09 90 00 - Painting and Coating: Field applied paint finish.
5. General Structural Notes on the drawings.

1.2 REFERENCES

A. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A297/A297M - Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application.
6. ASTM A283/283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
8. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
10. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

11. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
12. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
13. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
14. ASTM B177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use.
15. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
16. ASTM F436 - Standard Specification for Hardened Steel Washers.
17. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

B. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

C. SSPC: The Society for Protective Coatings:
1. SSPC - Steel Structures Painting Manual.
2. SSPC SP 1 - Solvent Cleaning.
3. SSPC SP 10 - Near-White Blast Cleaning.
4. SSPC Paint 15 - Steel Joist Shop Paint.
5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months. Welding to be performed by WABO Certified welders conforming to Section 05 05 23.

D. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

1.4 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1.

B. Welding: Comply with Section 05 05 23.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.6 FIELD MEASUREMENTS

Verify field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel sections, plates, bars and other rolled shapes: Refer to the General Structural Notes on the drawings.

B. Steel Pipe: ASTM A53, Type E or S, Grade B, Schedule 40.

C. Bolts, nuts, washers: Refer to the General Structural Notes.

D. Welding Materials: AWS D1.1; type required for materials being welded.

E. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

2.2 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FACTORY APPLIED FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with one coat except where galvanizing is specified.

D. For steel fabrications with shop painting indicated on the drawings, refer to Section 09 90 00 - Painting and Coating.

2.4 FABRICATION TOLERANCES

A. Squareness: 1/8" maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16".

C. Maximum Misalignment of Adjacent Members: 1/16".

D. Maximum Bow: 1/8" in 48 inches.

E. Maximum Deviation From Plane: 1/16" in 48 inches.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Section 01 30 00 - Administrative Requirements: Coordination and project conditions. Verify field conditions are acceptable and are ready to receive Work.

### 3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

### 3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on design drawings or shop drawings.

D. Perform field welding in accordance with AWS D1.1 and Section 05 05 23.

E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

### 3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4" per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset From Alignment:1/4".

D. Maximum Out-of-Position: 1/4".

### 3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 06 10 00

# ROUGH CARPENTRY

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes structural floor, wall, and roof framing; floor, wall, and roof sheathing; preservative treatment of wood; fire retardant treatment of wood; miscellaneous framing and sheathing; backing boards; and concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
   1. Section 01 45 23 – Testing and Inspection Services.
   2. Section 06 20 00 - Finish Carpentry.
   3. General Structural Notes on the drawings.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

C. ASTM International:
   1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

D. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. National Institute of Standards and Technology: NIST PS 20 - American Softwood Lumber Standard.

F. National Lumber Grades Authority: NLGA - Standard Grading Rules for Canadian Lumber.

G. Northeastern Lumber Manufacturers Association: NELMA - Standard Grading Rules for Northeastern Lumber.

H. The Redwood Inspection Service: RIS - Standard Specifications for Grades of California Redwood Lumber.

I. Southern Pine Inspection Bureau: SPIB - Standard Grading Rules for Southern Pine Lumber.

J. Underwriters Laboratories Inc.: UL 723 - Tests for Surface Burning Characteristics of Building Materials.

K. West Coast Lumber Inspection Bureau: WCLIB - Standard Grading Rules for West Coast Lumber.

L. Western Wood Products Association: WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative materials, and application instructions.

C. Moisture Readings: submit three copies of moisture content readings for framing materials enclosed in walls and roof framing.

D. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

E. Urea Formaldehyde: Include manufacturer's literature stating that no plywood or sheathing components contain added urea formaldehyde.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: Certified by NIST PS 20.
   2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.

B. Surface Burning Characteristics: Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each fire retardant treated material.

E. Moisture Content: take moisture readings of lumber and plywood prior to enclosure in wall and ceiling assemblies.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect framing and sheathing materials from excessive exposure to moisture.

## PART 2 PRODUCTS

### 2.1 LUMBER MATERIALS

A. Lumber Grading Rules: WCLIB. Refer to the General Structural Notes on the drawings.

B. Beam, joist, purlin and stiffener roof framing: Refer to the General Structural Notes, 19% maximum moisture content, kiln dried.

C. Studding, plates, and misc. light framing: Refer to the General Structural Notes, 19% maximum moisture content.

D. Tropical woods will not be accepted unless FSC-certified.

### 2.2 SHEATHING AND UNDERLAYMENT MATERIALS

A. Refer to the General Structural Notes on the drawings.

B. Telephone and electrical panel boards: ¾" plywood, CDX, fire treated.

### 2.3 FIREBLOCKING AND DRAFTSTOPPING

A. Fireblocking: Solid lumber nominal 2 inches thick, structural wood panel, or particleboard.

B. Draftstopping: Gypsum board or plywood.
   1. Gypsum board, 1/2-inch thick.
   2. Plywood, 3/8-inch thick.

### 2.4 ACCESSORIES

A. Fasteners and Anchors:
   1. As listed in the General Structural Notes on the drawings.
   2. Fasteners: Hot dipped or Electro galvanized steel for high humidity, Z-Max or other special coating for treated wood locations, unfinished steel elsewhere.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

B. Structural Framing Connectors: refer to the General Structural Notes on the drawings.

C. Sill Gasket on Top of Foundation Wall or Concrete PT Deck: ¼ inch thick, plate width wide, closed cell polyethylene foam from continuous rolls; Dow, Owens Corning, ProtectoWrap, Reflectix, Inc., or equal.

D. Sheathing Glue: EWA AFG-01, waterproof of water base, air cure type, cartridge dispensed.

E. Building Paper: refer to Section 07 27 00 - Air Barriers and Water-Resistive Barriers.

2.5 FACTORY WOOD TREATMENT

A. Wood or Plywood: Water borne preservative treatment for lumber and plywood in conditions not subject to soil, weather, and/or continuous water contact to be sodium borate treatment, AWPA C31 for lumber and C9 for plywood.

B. Wood exposed to soil, weather and/or water: ACQ (Alkaline Copper Quat) or CA (Copper Azole) water borne preservative by Chemical Specialties, Inc. or alternate manufacturer approved by the Architect of arsenic and/or chromium free wood preservative. Recommended retention of 0.25 lb./cu. ft. for above ground applications, and 0.042 lb./cu. ft. for ground or concrete contact.

C. Moisture Content After Treatment: Kiln dried (KDAT).
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 FRAMING

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

C. Place horizontal members, crown side up.

D. Construct load bearing framing and curb members full length without splices.

E. Double members at openings as noted in the General Structural Notes on the drawings. Space short studs over and under opening to stud spacing.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions parallel to floor joists. Frame rigidly into joists.

G. Place sill gasket directly on concrete foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

H. Coordinate installation of plywood decking, glue laminated structural units, and wood joists/stiffeners.

I. Curb roof openings except where prefabricated curbs are provided. Construct curb members of solid wood sections. Form corners by alternating and lapping side members.

J. Coordinate curb installation with installation of decking and support of deck openings.

3.2 SHEATHING

A. Install sheathing perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay sheathing with tongue upwards.

B. Engage plywood tongue and groove edges. Allow expansion space at edges and ends.

C. Attach sheathing with adhesive and fasteners per the General Structural Notes on the drawings.

D. Provide solid wood blocking at edges of sheets between supporting framing members.

E. Cut roof sheathing to accommodate roof drains and flanges.

## 3.3 FIREBLOCKING AND DRAFTSTOPPING

A. Install fireblocking to cut off concealed draft openings.
   1. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally at maximum 10 feet on center.
   2. Connections Between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
      a. Horizontal floor and roof framing.
      b. Soffits, dropped ceilings, cove ceilings and other horizontal concealed spaces.
   3. Stairs: Install fireblocking between stair stringers at top and bottom of each run.

## 3.4 QUALITY ASSURANCE

A. Special Inspection: Refer to the General Structural Notes on the drawings for inspection of structural wood shear walls and attachments comprising the seismic force resisting system.

## 3.5 JOBSITE WASTE REDUCTION

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

G. Implement cut lists, prepare accurate materials lists, and implement jobsite efficiencies to reduce jobsite waste.

## 3.6 SITE APPLIED WOOD TREATMENT

A. Brush-apply two coats of preservative treatment on pressure-treated wood subject to site-sawn cuts.

B. Allow preservative to dry prior to erecting members.

## 3.7 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Framing Members: ¼" from indicated position, maximum.

C. Surface Flatness of Floor: ¼" in 10 feet maximum, and ½" in 30 feet maximum.

3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 06 20 00

# FINISH CARPENTRY

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes:
   1. Interior finish carpentry items: standing and running wood trim, moldings, and finish hardware installation.
   2. Exterior finish carpentry items: wood window and door trim, exterior decking.
   3. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

B. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

D. All materials/products to have no added urea formaldehyde (NAUF).

E. Related Sections:
   1. Section 06 10 00 – Rough Carpentry.
   2. Section 06 61 16 – Solid Surface Countertop
   3. Section 08 16 00 – Composite Doors.
   4. Section 08 71 00 – Door Hardware.
   5. Section 09 90 00 – Painting and Coating.
   6. Section 12 35 30 – Casework.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 – Basic Hardboard.
   2. ANSI A156.9 – Cabinet Hardware.
   3. ANSI A208.1 – Mat-Formed Wood Particleboard.
   4. ANSI A208.2 – Medium Density Fiberboard for Interior Use

B. APA-The Engineered Wood Association: APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. ASTM International:
   1. ASTM C1036 - Standard Specification for Flat Glass.
   2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Architectural Woodwork Institute: AWI - Quality Standards Illustrated.

E. American Wood-Preservers' Association: AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.

F. Federal Specification Unit: FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

G. Hardwood Plywood and Veneer Association: HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

H. National Institute of Standards and Technology: NIST PS 20 - American Softwood Lumber Standard.

I. National Electrical Manufacturers Association: NEMA LD 3 - High Pressure Decorative Laminates.

J. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
   2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

K. Underwriters Laboratories Inc.: UL 723 - Tests for Surface Burning Characteristics of Building Materials.

L. Window and Door Manufacturers Association: WDMA I.S.4 - Water-Repellent Treatment for Millwork.

M. Woodwork Institute: WI - Manual of Millwork.

## 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories, to minimum scale of 1-1/2 inch to 1 ft.

C. Product Data:
   1. Submit data on fire retardant treatment materials and application instructions.
   2. Submit data on attachment hardware and finish hardware.

D. Urea Formaldehyde: Include manufacturer's literature stating that no particleboard, plywood, OSB, MDF or other applicable wood products contain added urea formaldehyde.

E. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

F. Samples:
   1. Submit two samples of MDF trim 10 inch long.
   2. Submit two samples each of prefinished paneling, hardware items, and shop finishes.

## 1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI (Architectural Woodwork Institute), Custom Grade for opaque/painted finishes, and Premium Grade for transparent finishes.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 QUALIFICATIONS

Fabricator: Company or individual specializing in fabricating Products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect work from moisture damage.

1.7 FIELD MEASUREMENTS

Verify field measurements prior to fabrication.

1.8 SEQUENCING

Sequence work to ensure utility connections are achieved in orderly and expeditious manner.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with installation of associated and adjacent components.

PART 2 PRODUCTS

2.1 GENERAL

A. Moisture content of finish woods not more than **9%** when delivered to the building.

B. Surface quality of the wood: Contractor shall take care in selecting the best face and edge of each piece, and consider its use and location. Materials shall have no visible milling or planing marks.

2.2 MATERIALS

A. All materials and assemblies are to be in accordance with reference AWI Manual “Premium Grade” for transparent finished items and “Custom Grade” for opaque (painted) finished items except as otherwise modified. Tropical woods will **not** be accepted unless FSC-Certified.

B. Interior MDF Mouldings:
   1. Paint Grade: Formaldehyde-free Medium Density Fiberboard (MDF). Profiles as indicated.
   2. Finish: Per Section 09 90 00.
   3. Window sill at all locations, sill and apron: Pre-primed 5/4 x stock for sill, 1/2” x 4” apron.
   4. Door & window casework: Pre-primed 1/2" x 4”.

C. Plywood:
   1. In accordance with referenced AWI, PS 1-74, and the like, Douglas Fir.

D. Adhesive for woods:
   1. Interior woodwork: Low-VOC FS MMM-A-125C, Type II, water and mold resistant. Use ASTM D 3110 dry-use type for laminated and finger-jointed members, certified in accordance with ASTM C557 and complying with required VOC regulations, water-based contact cement and water-based construction adhesive.
   2. Exterior finish woodwork: ANSI/HPMA HP 1983, Type I, air cure waterproof type. Use ASTM D 3110 wet-use type for laminated and finger-jointed members.

## 2.3 ACCESSORIES

A. FABRICATION Fasteners: Of size and type to suit application as required by the Building Code or as approved by the Architect. All rough hardware subject to moisture to be hot-dipped galvanized.

B. Wood Filler: Oil base, low VOC, tinted to match surface finish color.

## 2.4 FABRICATION

A. Fabricate to AWI Custom or Premium standards per Quality Assurance provisions above.

B. Shop assemble work for delivery to site, permitting passage through building openings.

C. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

D. Workmanship to be “First-Class Workmanship”
   1. Finish exposed surfaces smooth, free from tool and machine marks.
   2. Use concealed fastening wherever possible.
   3. Kerf backs of members more than 5” wide, or more than 1” net thickness.
   4. Joints: Make tight and form to conceal shrinkage, as far as possible.

E. Fitting and Adjustment: Regardless of tolerances specified for individual components, forming proportions of working assemblies, make final fitting and adjustments as required.

## 2.5 SHOP FINISHING

A. Sand work smooth and set exposed fasteners.

B. Apply wood filler in exposed fastener indentations.

C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with Section 09 90 00 for transparent and opaque finishes as noted on the drawings.

E. Seal, and finish exposed to view surfaces.

F. Seal internal surfaces and semi-concealed surfaces.

G. Prime paint or seal surfaces in contact with cementitious materials.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of backing and support framing.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### 3.2 INSTALLATION

A. Install work in accordance with AWI Custom and Premium quality standard as noted in Quality Assurance provisions above.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install interior wood trim with nails at 16 inches on center. Set nail heads and follow with putty to flush with surface. Carefully select the color of the putty to match the background color of the wood. Where wood color varies, select a putty color, or add stain to the putty, to match the wood color. It is not acceptable to use one putty color for all areas if the wood color varies.

E. Install prefinished paneling with full bed contact adhesive applied to substrate.

F. Preparation For Site Finishing (opaque):
   1. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
   2. Site Finishing: Refer to Section 09 90 00.
   3. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

### 3.3 INSTALLATION OF WORK FROM OTHER SECTIONS

A. Installation of solid core doors: For all pre-hung or field-hung solid core doors, the following special procedure shall apply. It is required that all screws on the top hinge penetrate through solid back into the wall framing behind the door frame. Replace the screws pre-packaged with the hinge with flat head screws, same finish as the pre-packaged screws, with sufficient length to penetrate the wall framing. This is required to prevent the settling of the door away from the frame at this hinge. Architect will inspect this procedure on a spot basis during installation.

B. Installation of work from other Sections: Install all items provided in other Sections and not specifically installed by other trades. Conform to finish carpentry installation requirements specified in this Section. Items to be installed include but are not limited to those items listed in "Related Work".
   1. Install finish hardware specified in Section 08 71 00. Installation by skilled mechanics. Conform to hardware manufacturer's instructions, and to Code requirements.

2. Adjust moveable parts to operate smoothly at time of acceptance. Make further adjustments as necessary during warranty period.
3. Replace hardware that has been damaged during installation.
4. Make mortises accurately to exactly receive hardware. Depth of mortises to be such that hardware is flush with finished surface.
5. Place doorstops and holders to allow maximum swing. Doors not to contact anything by stop.
6. Placement: locate hardware on doors as noted in Section 08 71 00.
7. After hardware installation, clean all surfaces of mortar, paint and other contaminants. Lubricate moving parts, or replace parts with cannot be lubricated and do not function properly.

3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

3.5 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Indicated Position: 1/16 inch.

C. Maximum Offset from Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

# SECTION 06 30 00

# WOOD TREATMENT

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

The work under this section shall conform to the requirements of Division 00 (Procurement and Contracting Requirements), Division 01 (General Requirements)--including all General Requirements, all Supplemental/Special Requirements, and all governmental requirements, as identified in Division 00 and 01 of this Project Manual.

### 1.2 WORK INCLUDED

A. Wood preservative-treatment of indicated material.

B. Work includes, but is not limited to:
   1. Wood plates and members resting on or embedded in concrete or masonry not in direct contact with soil or water.
   2. Wood exposed to weather and embedded-in or fastened to concrete.
   3. Other wood materials exposed to moisture, weather or dampness where indicated in drawings.

### 1.3 RELATED WORK

Coordinate related work specified in other parts of the Project Manual, including but not limited to the following:
1. Section 03 30 00 – Cast In Place Concrete
2. Section 06 10 00 – Rough Carpentry
3. Section 07 45 00 – Rainscreen System

### 1.4 REFERENCE STANDARDS

A. American Wood Preserver's Association (AWPA): Standard Specifications and AWPA C2 (lumber) and C9 (plywood).

B. UBC Standard 25-12.

C. ASTM D 1760 – Specification for Pressure Treatment of Timber Products.

### 1.5 STAMP

All pressure treated products shall bear the stamp of an independent quality control agency. The stamp shall identify treatment facility, date of treatment, treatment method, dryness, and quality control agency. Approved agencies include: A.W.P.I., Southwestern laboratories, A.W. Williams, and California Lumber Inspection Service.

### 1.6 TREATED PRODUCT DELIVERY, STORAGE, AND HANDLING

In accordance with Section 06 10 00 and following: Keep covered and dry until used - Store treated lumber with spacers between.

## PART 2 PRODUCTS

2.1 MATERIALS AND METHODS

A. Wood or plywood: Material to be pressure treated specified/Section 06 10 00 and as shown on drawings.
   1. Pressure treatment: Where indicated as “treated” on drawings or as required by code, include bottoms of wood plates in contact with concrete or masonry walls, earth supported or exposed at exterior; rooftop curbs, cants, and embedded wood nailers in concrete walls.
   2. Treatment to consist of using Alkaline Copper Quaternary (ACQ). Ammoniacal Copper Arsenate (ACA) may be used as an alternative (by written substitution request, and approved by Architect), while Ammoniacal Copper Zinc Arsenate (ACZA) may not. Borate treatment is allowed for wood used for rainscreen furring and for wall plates. Pressure treatment of required lumber in accordance with AWPA Standard C-2 to retention of 0.25 lb. per cu. ft. (above ground condition of use). Water-borne preservatives to be in accordance with AWPA standards and specifications, Article 9.09., particularly 9.09.3(4). Faces of exposed decking material shall be free of incising marks.
   3. Wood preservative surface application: Manufactured by Chemical Specialties or approved. Use clear where application will be exposed to view.

B. Factory pressure treat all wood, plywood, or lumber indicated to be treated in accordance with the following APWA Standards:
   1. When using Alkaline Copper Quaternary (ACQ), refer to manufacturer’s recommendations for wood to be used in an above ground or in ground application.
   2. When using Ammoniacal Copper Arsenate (ACA)
      a. Above ground/out of weather use: LP-2, with ACA to a retention of 0.25lb./cu. ft.
      b. In contact with ground/in weather or embedded in concrete in the ground: LP-22, with ACA to 0.40 lb./cu. ft.

2.2 MOISTURE CONTENT

Season after treatment to moisture content required for non-treated materials - refer to Section 06 10 00.

PART 3 EXECUTION

3.1 INSTALLATION

Materials specified this Section installed under Section 06 10 00.

3.2 FIELD CUTS

Treat field cut ends and rippings with heavy brush coat of CCA in order to comply with AWPA M4.

3.3 FIELD QUALITY CONTROL

A. Verify that treated materials are installed in designated areas and that type designations listed in Part 2 match with field conditions and use.

B. Verify presence of appropriate stamp and grademark on installed materials.

## 3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 06 61 16

# QUARTZ COUNTERTOPS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Work includes but is not limited to the furnishing and installation of quartz countertops for all the kitchens and bathrooms in all residential apartments and countertops in the Office building.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 06 20 00 – Finish Carpentry.
3. Section 09 90 00 – Painting and Coating
4. Section 12 35 30 – Casework.

### 1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop drawings: Provide Submit fully dimensioned shop drawings showing countertop layouts, joinery, terminating conditions, substrate construction, cutouts and holes.

C. Product data: Submit copies of manufacturer’s product data, performance data, installation, and maintenance instructions. Provide color chart or samples as required for Owner/Architect's selection/confirmation of colors.

D. Samples: Submit selection and verification samples for each color, pattern, and finish required.

E. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

F. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

### 1.2 Reference Standards

A. ANSI Z124.3: American National Standard for Plastic Lavatories.

B. ANSI Z124.6: American National Standard for Plastic Sinks.

C. ASTM C 834: Standard Specification for Latex Sealants.

D. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

E. ASTM D 256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

F. ASTM D 570: Standard Test Method for Water Absorption of Plastics.

G. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.

H. ASTM D 696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30oC and 30oC with a Vitreous Silica Dilatometer.

I. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

J. ASTM D 792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

K. ASTM D 2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

L. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

M. ASTM G 21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

N. ASTM G 22: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.

O. ASTM G 155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

P. NEMA LD-3: High Pressure Decorative Laminates.

Q. NSF/ANSI Standard 51: Food Equipment Materials.

R. SCAQMD Rule 1168: Adhesive and Sealant Applications.

S. UL 2818: GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings.

## 1.3 QUALITY ASSURANCE

A. Section 00 73 13 - Supplementary Conditions.

1. Fabricator Qualifications: Minimum of three years documented experience in fabricating quartz countertops similar in scope and complexity to this Project. Currently certified by the manufacturer as an acceptable fabricator.
2. Installer Qualifications: Minimum of three years documented installation experience for projects similar in scope and complexity to this Project, and currently certified by the manufacturer as an acceptable installer.

## 1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Deliver fabricated work in protective packing to minimize any potential damage to

work prior to installation.

C. Do not deliver any materials to site until areas are ready to receive them for installation.

D. Store all materials indoors in a dry area away from extreme temperatures and sunlight.

E. Handle all quartz fabricated materials in such a way as to prevent damage to other finished surfaces.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Adhesive: Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 degrees F.

1.5 WARRANTY

A. The manufacturer shall provide a limited warranty that the materials provided under this section shall not develop visible defects or otherwise fail due to manufacturing defects within a period of ten (10) years from the date of acceptance by the Owner.

PART 2 PRODUCTS

2.1 QUARTZ COUNTERTOP

A. Listed Manufacturer: DDN Interior Supply.

B. Other Manufacturers:
   1. Basix International, Basix Quartz Series
   2. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Material: Cast, mineral-filled, homogeneous, non-porous, decorative surface alloy comprised of polyester and acrylic components conforming to ISSFA-2-01.

D. Finish: Surface finish shall be manufacturer’s standard finish, or an appropriate finish selected by the owner/architect. Fabricator will supply a sample of the finish to be approved by the architect prior to fabrication of the product

E. Color: selected by Architect/Owner from manufacturer's Stock color palette.

F. Horizontal Surfaces;
   1. Kitchen Countertop: Horizontal surfaces of 2cm thick material with 4cm built-up edge. Provide kitchen countertops using manufacturer’s approved adhesive.
   2. Vanity Top: Horizontal surfaces of 2cm thick material with 4cm built-up built-up edge. Provide vanity tops using manufacturer’s approved adhesive.
   3. Backsplashes: 4” vertical backsplash and side splash surfaces of 1/2" thick material using manufacturer’s approved adhesive.

2.2 ACCESSORY PRODUCTS

A. Sealants: 100% silicone to be matched to quartz sheet color.

B. Adhesives:
   1. Flexible adhesives shall be 100% silicone and shall be matched to quartz sheet color.
   2. Rigid structural adhesive shall be manufacturer's seam adhesive.
   3. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Provide all product types from the same manufacturer for consistency and uniformity.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect work of all other trades and verify conditions as complete and satisfactory for appliance installation.

B. Field verify dimensions prior to fabrication.

C. Coordinate requirements for blocking and structural supports to ensure adequate means for installation.

D. Discrepancies: In the event of discrepancy, immediately notify Architect. Do not proceed until all discrepancies have been fully resolved.

3.2 FABRICATION

A. Fabrication shall be performed by an ISFA accredited fabricator or who has demonstrated proficiency in the types of work required by this project.

B. Shop fabricated components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings.

C. Special techniques: Comply with the manufacturer's recommendations for the use of specific types of stationary equipment and stationary tools. Site fabrication and finishing processes shall be in accordance with the manufacturer's recommendations for working with the quartz fabrication materials.

D. Form seams between components, unless otherwise indicated, using quartz manufacturer's standard seam adhesive. Adhesive shall be color coordinated to match quartz material color and shall form inconspicuous seams.

E. Provide cutouts for plumbing fittings and bath accessories as indicated on the drawings and as recommended by the equipment and quartz manufacturer.

F. Cut and finish component edges with clean, sharp returns. Route radii and contours to exact template sizes. Repair or reject defective or inaccurate work

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions and approved shop drawings.

B. Prepare substrate, plane, plumb and level, secure in place with all fasteners set flush. Shim supporting structure as required to provide an acceptable surface for attaching finish materials.

C. Install components, plane, plumb and level, in accordance with approved shop drawings and product data.

D. Pre-fit finish material in place. Scribe material as required to provide proper fit with adjacent materials.

E. Provide additional support for material seams in both horizontal and vertical locations. Separation/release paper shall be provided between all supports and seams to prevent direct adhering of finish material to substrate.

F. Form field joints using manufacturer's recommended adhesive, with inconspicuous joints in finished work.

G. Prior to installing quartz fabrication, make sure that substrate is clean and dry. Place silicone "dabs" on substrate in accordance with manufacturer's recommendations.

H. Provide backsplashes and sidesplashes as indicated on the drawings. Adhere backsplashes and sidesplashes to countertops using manufacturer's recommended color matched flexible adhesive.

I. Keep components and hands clean during installation. Remove adhesives, sealants and other stains from the work as they occur.

J. During installation, protect surfaces of quartz fabrications from damage until all components have been installed.

K. Make plumbing connections to sinks in accordance with Division 15, Mechanical. Do not over tighten connections that are in direct contact with or attached to quartz fabrications.

## 3.4 PROTECTION OF INSTALLED WORK

A. After fabrication and installation, protect surfaces of quartz fabrications from damage until accepted by the Owner. Replace any damaged material prior to acceptance

## 3.5 CLEANING FOR QUARTZ FABRICATION

A. After installation, all surfaces shall be cleaned to remove contaminants. After cleaning, all work shall be protected against damage until it is accepted by the Owner. Thereafter, it shall be the responsibility of the Owner to maintain protection and provide final cleaning

## 3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

SECTION 06 82 00

ARCHITECTURAL FIBERGLASS RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes supplying and installing pultruded guardrail and handrail in compliance with IBC 2018.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 03 30 00 - Cast-in-Place Concrete
3. Section 09 90 00 – Painting and Coatings.

1.2 REFERENCES

A. ASTM International:
1. ASTM D-638-Tensile Properties of Plastics.
2. ASTM D-790-Flexural Properties of Unreinforced and Reinforced Plastics.
3. ASTM D-2344-Apparent Interlaminar Shear Strength of parallel Fiber Composites by Short Beam Method.
4. ASTM D-495-High Voltage, Low-current, Dry Arc Resistance of Solid Electrical Insulation.
5. ASTM D-84-Surface Burning Characteristics of Building Materials.

B. GLASRAIL® Installation Book, https://glasrail.com/images/InstallationGuide.pdf

C. The International Building Code, 2015.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on products describing size, finish, structural design data, structural properties data, and attachment methods.

C. Shop Drawings: Submit manufacturer’s shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes and connection details

D. Samples: Submit four samples of each specialty product where Architect is required to make a finish selection, illustrating color and finish choices.

E. Manufacturer's Installation Instructions including certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, sealed by a Professional Engineer.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with deck and balcony construction.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company and employees specializing in work of this Section, with minimum 5 years documented experience.

B. Manufacturer shall offer a minimum 3-year limited warranty on all FRP products against defects in materials and workmanship.

C. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials are to be new and delivered to the site in an undamaged condition. In the event of damage, immediately make repairs and/or replace as necessary to the approval of the Owner’s Representative and at no additional cost to the Owner.

B. Handle all components carefully to prevent damage during shipment. Brace and insulate to prevent abrasion, cracking, chipping, bending, twisting, scratching, other deformations and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities between 70 an d85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 PRODUCTS

2.1 FIBERGLASS RAILINGS

A. Listed manufacturer: GLASRAIL® Structural Pultruded Fiberglass Railing System

B. Section 01 25 13 – Product Substitution Procedures.

C. All posts and rails are to be FRP structural shapes manufactured by the pultrusion process. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the Contract Documents.

D. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

E. Resins shall be isophthalic polyester with chemical formulation necessary to provide corrosion resistance, strength & other physical properties as required.

F. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spot, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

G. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin, 2) a synthetic surfacing veil to help produce a resin rich surface, and 3) an appropriate UV resistant coating for outdoor exposures.

H. All FRP products shall have a tested flame spreading rating of 25 or less per ASTM E- 84 Tunnel Test.

I. Top and bottom rails are to be 1.75" x 0.125" (44.4mm x 3.2 mm) wall square tube, the posts are to be 2.1125" x 0.1875" (53.9 mm X 4.8 mm) wall square tube and kickplate is to be ½" deep and 4" wide with two reinforcing ribs.

J. The completed handrail installation shall meet the following load requirements with a minimum factor of safety of 2.0:
1. Concentrated Load: 200lb (891 N) applied in any direction at the top rail.
2. Uniform Load: 50lb/lf (730.5 N/m) of the top rail in any direction.
3. Loads are assumed not to act concurrently.

K. All fasteners used in the railing system are to be 316 SS. Rivets to be 18-8 SS.

L. Pultruded structural shapes used in the handrail and guardrail are to have the minimum longitudinal mechanical properties listed below:

| Property | ASTM Method | Value/Units |
|---|---|---|
| Conductivity | C177 | 4 |
| Coefficient of Linear Exp. | D696 | .000006 |
| LONGITUDINAL DIRECTION | | |
| Tensile Strength | D638 | 35,000 psi |
| Tensile Modulus | D638 | 2.5 x $10^6$ psi |
| Flexural Strength | D790 | 30,000 psi |
| Flexural Modulus | D790 | 2 x $10^6$ psi |
| Izod Impact | D256 | 25 |
| TRANSVERSE DIRECTION | | |
| Tensile Strength | D638 | 10,000 psi |

## PART 3 EXECUTION

### 3.1 FABRICATION

A. The handrail post/rail connection is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or places. The bottom rail is to be installed through the post at the prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into the machined, u-shaped pocket formed into top of the post such that the rail is located at the center of the post. All exposed post corners are to be radiuses to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 6’-0” (1.83 m).

B. The bases of the posts are to be attached according to the contract drawings. The bases of the posts are to be reinforced to a height of 8.5” (254 mm).

C. To avoid embrittlement at cold temperature and loss of strength at high temperature, PVC or CPVC connectors should not be used as a load-carrying component of the handrail system.

D. All shop fabricated cuts are to be coated with a vinyl ester resin to provide maximum corrosion resistance. Field cuts are to be similarly coated by the contractor in accordance with the manufacturer’s instructions

### 3.2 PREPARATION

A. Contractor is responsible for all temporary barricades, enclosures and protection of adjacent property and existing work. These are to be in place before operations are started. Coordinate this work with other work and trades.

B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Follow manufacturer's printed instructions, using manufacturer's standard attachment devices and procedures.

C. Leave product and adjacent area clean and free of defects.

### 3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 21 13

# BOARD INSULATION

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section is for stone fiber board insulation for continuous thermal insulation over existing and new exterior wall and roof assemblies.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 07 27 00 – Air Barriers and Water-Resistive Barriers.
2. Section 07 45 00 – Rainscreen System
3. Section 07 90 00 – Joint Protection.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C165 - [2012], Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
2. ASTM C303 - [2010], Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
3. AST C423 – [2009a], Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. ASTM C518 - [2015], Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
5. ASTM C612 - [2014], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C665 - [2012], Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction & Manufactured Housing.
7. ASTM C795 - [2013], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
8. ASTM C1104/C1104M - [2013)], Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
9. ASTM C1338 - [2014], Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
10. ASTM E84 - [2015], Standard Test Method for Surface Burning Characteristics of Building Materials.

11. ASTM E96/E96M - [2016], Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, and limitations.

C. Installation: Include manufacturer's specifications and installation instructions.

D. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

1.4 QUALITY ASSURANCE

A. Board Insulation Installer Quality Assurance: Work experience of 5 years minimum with work similar to work of this Section.

B. **Wall and Window Installation Mock-Up:** The General Contractor will direct the building of a mock-up wall independent of the building envelope for the Architect and Owner to review with all products and trades included in the exterior wall assemblies. At the mock-up wall, all products of the each of the exterior wall assemblies (framing and sheathing, windows, rigid insulation, rainscreen furring, metal flashing, self-adhering membranes, air/water barriers, cladding materials) will be inspected at various stages of installation. This mock-up wall will be evaluated for constructability and weather-tight qualities and may be tested for weather-tight qualities. Modifications, if any, to the exterior wall assemblies resulting from the mock-up will be discussed, documented by the contractor and incorporated into the work. Contractor to coordinate with mock-up required in Section 08 53 00 Plastic Windows and Sliding Glass Doors and in Section 07 21 16 Blanket Insulation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
1. Deliver material in accordance with Section 01 60 00 - Product Requirements.
2. Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
3. Ensure insulation materials are not exposed to moisture during delivery.
4. Replace wet or damaged insulation materials.

B. Storage and Handling Requirements: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in original packaging until installed.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

1.7 WARRANTY

A. Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

PART 2 PRODUCTS

2.1 BOARD INSULATION

A. Listed Manufacturer – Mineral Wool: ROXUL, Inc.

B. Other Manufacturers:
   1. Substitutions: Section 01 25 13 – Product Substitution Procedures.

2.2 COMPONENTS

A. Mineral Wool: COMFORTBOARD 80, rigid, mineral wool insulation board to ASTM C612:
   1. Thickness: as indicated on the drawings.
   2. Fire performance: Non-combustible to ASTM E136.
   3. Flame Spread: 0 per ASTM E84
   4. Smoke developed: 0 per ASTM E84.
   5. Thermal Resistance: R value per 1 inch at 75ºF: 4.2 h $ft^2$ ºF/Btu to ASTM C518.
   6. Water Vapor Permeance: 31 perm maximum.
   7. Moisture sorption: 0.05% maximum to ASTM C1104/C1104M.
   8. Recycled Content: Minimum 40% recycled content post-consumer.
   9. Urea-formaldehyde free.
   10. Non-setting, non-staining, acoustically tested.
   11. Locations: Exterior walls of existing residential building.

B. Accessories:
   1. Mechanical fasteners in accordance with insulation manufacturer's written recommendations.

C. Product shall meet the requirements of California's practice for testing VOCs from building materials using small chambers, Green Guard for Children and Schools certification can be used as a proxy.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. General:
   1. Install insulation in accordance with manufacturer's written installation instructions.
   2. Install insulation to maintain continuity of thermal protection to building elements and spaces.
   3. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or penetrating insulation. All voids or gaps should be filled.
   4. Keep insulation minimum [3] inches from heat emitting devices such as recessed light fixtures, and minimum [2] inches from sidewalls of chimneys and vents.

B. Installation of Insulation Board:
   1. Install insulation board using mechanical fasteners in accordance with insulation manufacturer's written recommendations.
   2. Attach insulation board with 1.5 inches concrete nails and seal with bitumen sealing compound.

3.3 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 21 16

# BLANKET INSULATION

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes batt insulation in exterior wall and roof assemblies.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 13 for additional requirements.

C. Related Sections:
1. Section 07 21 13 - Board Insulation.
2. Section 07 27 00 - Water-Resistive Barriers.
3. Section 07 84 00 - Firestopping.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

B. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.: UL 723 - Tests for Surface Burning Characteristics of Building Materials.

D. Green Guard for Children and Schools Certification

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, and limitations.

C. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

D. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

E. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

1.4 QUALITY ASSURANCE

A. **Wall and Window Installation Mock-Up:** The General Contractor will direct the building of a mock-up wall independent of the building envelope for the Architect and Owner to review with all products and trades included in the exterior wall assemblies. At the mock-up wall, all products of the each of the exterior wall assemblies (framing and sheathing, windows, rigid insulation, rainscreen furring, metal flashing, self-adhering membranes, air/water barriers, cladding materials) will be inspected at various stages of installation. This mock-up wall will be evaluated for constructability and weather-tight qualities and may be tested for weather-tight qualities. Modifications, if any, to the exterior wall assemblies resulting from the mock-up will be discussed, documented by the contractor and incorporated into the work. Contractor to coordinate with mock-up required in Section 08 53 00 Plastic Windows and Sliding Glass Doors and 07 21 13 Board Insulation.

B. Insulation Installed in Concealed Locations Surface Burning Characteristics:
   1. Batt Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with Section 07 26 00 for installation of vapor retarder.

PART 2 PRODUCTS

2.1 BATT INSULATION

A. Listed Manufacturer: CertainTeed Corporation, Certapro AcoustaTherm Batt Insulation, unfaced fiberglass batts.

B. Other Manufacturers:
   1. Knauf Insulation (EcoBatt).
   2. Johns Manville.
   3. Owens Corning.
   4. Guardian Fiberglass, Inc.
   5. Celotex Corporation.
   6. Substitutions: Section 01 25 13 – Product Substitution Procedures.

2.2 COMPONENTS

A. Acoustic Batt Wall and Ceiling Insulation:
   1. Facing: Unfaced.
   2. Thickness: as indicated on the drawings.
   3. Flame Spread: maximum 25 per ASTM E84.
   4. Smoke developed: maximum 50 per ASTM E84.
   5. Recycled Content: minimum 25% recycled content post-consumer.
   6. Urea-formaldehyde free.

B. Thermal Batt Insulation: ASTM C665; preformed glass or mineral fiber blanket; friction fit, conforming to the following:

1. Thermal Resistance for exterior wall assemblies: R-15 blankets or as otherwise indicated on the drawings.
2. Facing: Unfaced.
3. Flame Spread: maximum 25 per ASTM E 84.
4. Smoke developed: maximum 50 per ASTM E 84.
5. Recycled Content: minimum 25% recycled content post-consumer.
6. Urea-formaldehyde free.

C. Acoustic Sealant:
1. USG, Presstite, Tremco or AC Horn.
2. Non-setting, non-staining, acoustically tested.

D. Securing Pins:
1. Impaling clip of galvanized steel with washer retainer, to be adhered to surface to receive insulation, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

E. Product shall meet the requirements of California's practice for testing VOCs from building materials using small chambers, Green Guard for Children and Schools certification can be used as a proxy.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

### 3.2 INSTALLATION

A. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

D. For insulation installed in parking garage ceilings, install chicken wire panels around fire sprinkler heads in compliance with NFPA and local standards.

E. Coordinate Work of this section with installation of vapor retarder specified in Section 07 26 00.

### 3.3 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Refer to Section 01 74 19 for specific requirements.

END OF SECTION

# SECTION 07 27 00

# WEATHER-RESISTIVE BARRIERS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes vapor permeable air and water-resistive barriers (WRB) installed as a drainage plane in exterior wall assemblies and associated accessories.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Sections 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 07 21 13 – Board Insulation.
2. Section 07 45 00 – Rainscreen System.
3. Section 07 62 00 – Sheet Metal Flashing and Trim.
4. Section 07 90 00 – Joint Protection.
5. Section 08 53 00 – Plastic (PVC) Windows.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
2. ASTM C1193; Standard Guide for Use of Joint Sealants.
3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting.
4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics.
5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
7. ASTM E 1677 - Specification for an Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.
8. ASTM E 2178 - Test Method for Air Permeance of Building Materials.

B. AATCC – American Association of Textile Chemists and Colorists:
1. Test Method 127 Water Resistance: Hydrostatic Pressure Test.

C. TAPPI:
1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area).
2. Test Method T-460; Air Resistance (Gurley Hill Method).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on material characteristics, performance criteria, and limitations of each component.

C. Manufacturer's Installation Instructions: Submit preparation, installation requirements and techniques, product storage and handling criteria.

D. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Installer shall have experience with installation of similar weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.
3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by materials manufacturers before, during and after installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver weather barrier materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store weather barrier materials as recommended by system manufacturer.

1.7 SEQUENCING

Sequence Work to permit installation of materials in conjunction with related materials and seals.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work of this section with sections referencing this section.

PART 2 PRODUCTS

2.1 MANUFACTURER AND PRODUCT

A. Manufacturer, Product:
1. Dupont Tyvek HomeWrap and related assembly components.
2. Substitutions: Section 01 25 13 – Product Substitution Procedures.

B. Performance Criteria:

1. Air Penetration: <.004 cfm/ft2 at 1.57 psf, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
2. Water Vapor Transmission: Water Vapor Transmission: 56 perms, when tested in accordance with ASTM E96-05, Method A.
3. Water Penetration Resistance: 250 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 1.8 oz/yd$^2$, when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: 1200 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 30/30 lbs/in., when tested in accordance with ASTM D882.
7. Tear Resistance: 8/6 lbs, when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 15, Smoke Developed: 15.

B. Accessories:
1. Seam Tape: 3 inch wide, DuPont™ Tyvek® Tape as distributed by DuPont Building Innovations.
2. Fasteners: DuPont™ Tyvek® Wrap Caps, as distributed by DuPont: #4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.
3. Adhesive: provide adhesive recommended by weather barrier manufacturer.
4. Primer: Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

C. Sealant: Dow 758 Silicon Weather Barrier Sealant or as recommended by weather barrier manufacturer.

D. Flashing

## PART 3 EXECUTION

### 3.1 PREPARATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not begin installation until all unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. In general, strictly comply with manufacturer's printed installation instructions. Refer to the drawings for application sequence for products of this Section.

B. Carefully and accurately lay out, cut, fit and install to detail.

C. Install products weather-fashion, facilitating the passage of water or moisture toward drainage paths or weep holes as detailed.

D. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

E. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain weather barrier plumb and level.

F. Extend bottom roll edge over sill plate interface 2” to 3” minimum. Seal weather barrier with sealant or tape. Shingle weather barrier over back edge of thru-wall flashings and seal weather barrier with sealant or tape. Ensure weeps are not blocked.

G. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.

H. Window and Door Openings: Extend weather barrier completely over openings.

I. Weather Barrier Attachment:
   1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, spaced 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

3.3 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION (For Use with Flanged Windows)

A. Cut weather barrier in an “I-cut” pattern. A modified I-cut is also acceptable.
   1. Cut weather barrier horizontally along the bottom and top of the window opening.
   2. From the top center of the window opening, cut weather barrier vertically down to the sill.
   3. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier membrane at window head to expose 8 inches of sheathing. Temporarily secure weather barrier membrane flap away from sheathing with tape

3.5 FLASHING

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit adjacent work to damage work of this section.

3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store

protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

SECTION 07 27 26

AEROSOL-APPLIED SEALANT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aerosol-applied, interior-surface sealant for air sealing.

1.2 RELATED SECTIONS

A. Section 06 10 00 Rough Carpentry

1.3 COORDINATION

1. Coordinate air barrier and installation requirements with progress of related and adjacent work in progress.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review installation details, mockups, testing, protection, and work scheduling.

1.5 SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrates.
   2. Technical Data: Physical and performance properties of product.

B. Sustainable Design Submittals:
   1. Product Data: Indicating VOC content.
   2. Laboratory Test Reports: Sealants, indicating compliance with requirements for low-emitting materials.

C. Certificate of Completion: Documenting shows pre- and post-seal leakage (pressurization test).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer must be certified by the manufacturer to conduct installations, performance testing and certifying work result.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original, undamaged packages.

B. Storage: Store per manufacturer's written instructions. Store in original, undamaged packages in a clean, dry, protected location with temperatures from 40 to 100 degrees. Do not allow product to freeze.

C. Handling: Shelf life of 1 year when stored in accordance with storage instructions.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Application temperature: Above 40 degrees F and rising. If installing below 40 degrees F, please refer to Cold Weather Air Barrier Installation Technical Bulletin or contact manufacturer for instructions.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply product to damp or wet substrates.

1.9 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty.

PART 2 - PRODUCTS

2.1 AEROSOL-APPLIED, WATERBORNE ACRYLIC SEALANT

A. Basis of Design: AeroBarrier X1. Part Number: AERO-128. Manufactured by Aerobarrier; 7989 South Suburban Road, Centerville OH 45458; Phone: 937-428-9300; Email: info@airbarrier.net
   1. Aerosol-Applied, Waterborne Acrylic Sealant: Stable, non-toxic, air sealing system utilizing a computerized process to pressurize an interior space and install to seal leaks in the building enclosure from the inside.
   2. Product Description:
      a. Seals leaks up to ½ inch and as small as a human hair.
      b. Most economical to install at rough in or drywall stage of construction but can be applied to unoccupied, finished spaces.
      c. Sealant does not stick to vertical serfaces like walls, windows, or doors.
      d. UL GreenGuard Gold certified.
      e. Ultra-Low VOC: 12 grams per liter. No off gassing.
      f. Solids: 18.5 to 21.5 percent.
      g. Sealant Base: Acrylic.
      h. Color: White.
      i. Dispersion: Water.

j. Application: aerosol.

B. Performance Requirements:
1. Sealant will enhance the primary air barrier capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
2. Air-Barrier Leakage per ASTM E2357: 0.04 cu ft per min per sq ft of surface area at 1.57 lbf/sq ft (0.2 L per sec per sq m of surface area at 75 Pa).
3. Standards Compliance:
a. GreenGuard Gold Certification.
b. ASTM E84 – Surface Burning Characteristics of Building Materials.
c. ASTM C719 – Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement.
d. ASTM D543 – Standard Practices for Evaluating the Resistance of Plastic to Chemical Reagents.
e. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.
f. ASTM E2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer for conditions affecting performance of the Work.
1. Verify substrates are free of contaminants and moisture.
2. Proceed after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

A. Prep internal area by covering any openings that won’t be sealed. This includes taping or covering any designed or intentional openings and any finished horizontal surfaces within the space.
1. Emitters: Set up throughout the area to be sealed.
2. Set Up Application Equipment: Includes blower door, emitters, hoses, and the master control unit.

### 3.3 INSTALLATION

A. Install materials in accordance with manufacturer's recommendations, approved submittals including the following:
1. Pressurize: Using a blower door, the space is pressurized.

2. Application: A computer measures and controls the entire process including controlling the temperature, pressure, humidity, and distribution of sealant within the space during the process.
3. Seal and Monitor: During application, air leakage results are controlled and monitored in real time. Results displayed are based on a pressurization test.
4. Application: Continue the application process until desired level of air tightness required is achieved.

## 3.4 FIELD QUALITY CONTROL

A. Air Seal Test: At the end of the process, conduct a post seal test to verify the sealing results. Installer and manufacturer shall provide a Certificate of Completion that shows pre- and post-seal leakage.
   1. Transitions at changes in direction and structural support at gaps have been provided.
   2. All penetrations have been sealed to the level reported in the post-seal test.

B. Tests: As determined by testing agency from among the following tests:
   1. System uses a standard blower door to measure envelope leakage during the process. Use a positive pressure blower door test for all leakage readings.
      a. Blower Door: Calibrated to meet ASTM Standard E779, E1554, CGSB-149.10-M86, EN 13829, ATTMA Technical Standard 1, NFPA 2001, RESNET and USACE.

## 3.5 CLEANING AND PROTECTION

A. Protect materials from damage during application and remainder of construction period, according to manufacturer’s written instructions.

END OF SECTION

SECTION 07 31 13

GLASS-FIBER-REINFORCED ASPHALT SHINGLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Asphalt shingles.
2. Moisture shedding underlayment, ridge, valley and eave protection.
3. Ridge and Intake venting.
4. Metal flashings and accessories.

B. The Owner has established sustainability goals for this project. It is a specific requirement of this Section that shingles meet the specified requirements for local production and recycled content.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria.

D. The Contractor shall inform the Owner and Architect of any conflicts between sustainable criteria and health, safety and durability

E. Related Sections:
1. Section 06 10 00 - Rough Carpentry.
2. Section 07 26 00 - Vapor Retarders.
3. Section 07 27 00 - Air Barriers and Weather Resistant Barriers.
4. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM B209 – Standard Specification for Aluminum and Aluminal-Alloy Sheet and Plate.
4. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
5. ASTM D225 - Standard Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules.
6. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D228 - Standard Test Method for Asphalt Roll Roofing, Cap Sheets, and Shingles.
8. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

9. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
10. ASTM D3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.
11. ASTM D3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
12. ASTM D3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
13. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
14. ASTM D4869 - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
15. ASTM D6380 - Standard Specification for Asphalt Roll Roofing (Organic Felt).
16. ASTM D6757 – Standard Specification for Inorganic Underlayment for Use with Steep Slope Roofing Products.
17. ASTM D7158 – Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method).
18. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
19. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
20. ASTM G21 – Determining Resistance of Synthetic Polymers to Fungi.

B. National Roofing Contractors Association:
   1. NRCA - The NRCA Steep Roofing Manual.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

D. Underwriters Laboratories Inc.:
   1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.
   2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
   3. UL 997 - Wind Resistance of Prepared Roof Covering Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Wind Resistance: Conform to applicable code for UL 580 wind uplift, UL 997 Wind Resistance for shingle types specified.

B. Wind Resistance: ASTM D3161; Class D, passes 90 mph minimum test velocity. Special fastening as required.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate Roofing layout and top and bottom course detailing transitions, including substrate requirements, weather-resistive barriers and all flashings, jointing methods and locations, fastening methods and locations, and installation details.

C. Product Data: Submit data indicating material characteristics, performance criteria, and limitations.

D. Samples: Submit two standard size samples of each shingle color indicating

color range and finish texture/pattern; for color and texture selection.

E. Manufacturer's Installation Instructions: Submit installation criteria and procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Inspection Report: Submit report of roof inspection verifying shingles are sealed. Indicate extent of areas that did not properly self-seal and what corrective measures were required.

H. Provide manufacturer's literature certifying that shingle products contain a minimum of 20% recycled content. Identify post-consumer and post-industrial percentages.

I. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Steep Roofing Manual.

B. Roof Covering Fire Classification: Minimum Class A when tested in accordance with ASTM E108 or UL 790.

C. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

D. Perform Work in accordance with City of Kirkland standards.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Anticipate and observe environmental conditions (temperature, humidity and moisture) within limits recommended by manufacturer for optimum results. Do not install products under environment conditions outside manufacturer’s absolute limits.

C. Take special care when applying WinterGuard Waterproofing Shingle Underlayment and shingles when ambient or wind chill temperature is below 45 degrees F. Tack WinterGuard in place if it does not adhere immediately to the deck.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish manufacturer’s lifetime warranty for asphalt shingles.

PART 2 PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Listed Manufacturer: CertainTeed Corporation Landmark Solaris.

B. Other Manufacturers accepted:
   1. Owens Corning TruDefinition® Duration® Shingles
   2. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Fiber glass-based asphalt shingles complying with ASTM specifications E 108 Class A or UL 790 Class A, D 3462, D 3161 Class “F”, D3161 Class “A” D 7158 (UL2390/D6381) Class H, D 3018 Type 1, D 3018, CSA A123.5, UL 2218, Cool Roof Rating Council (CRRC), Energy Star, Florida Building Code (FBC), Miami-Dade County Approved and International Code Council (ICC) Evaluation Report

D. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

E. Base Sheet: ASTM 15; asphalt-impregnated fiberglass-reinforced felt.

F. Flashings: Per Section 07 62 00 for installation under this section.

## 2.2 COMPONENTS

A. Ice Dam Membrane: ASTM D1970; self-adhering polymer modified bituminous sheet material, slip resistant surface, 40 mils thick, 36 inches wide, with strippable release paper to expose adhesive surface.

## 2.3 FALL ARREST/FALL RESTRAINT SYSTEM

A. “RIDGE-IT” as manufactured by Guardian Metal Products, Inc., 4050 Auburn Way North, Suite #4, Auburn, WA 98002 or other approved equal complying with all regulations, including but not limited to WISHA, OSHA, ANSI fall arrest and fall restraint, anchor point standards.

B. Description: 2” x 24” x 20 GA. ASTM B-504 Stainless Steel Strap doubled and one drop forged Zinc Chromate “D” ring installed at each end. Doubled straps are secured to each other by spot welding and a minimum of 8 - 1/4” holes are punched for use in attaching the anchor to the roof rafter or substrate Finished size is 2” x 12”.
   1. Steel Eyelet (“D” Ring): ASTM F-887-84; Drop Forged, 5000 lbs. proof load, 3/8” x 2” Steel, Zinc Plated

## 2.4 RIDGE, HIP, AND EAVE VENTS

A. Intake Vent: In-Vent: Cor-a-vent; IN-vent On-the-roof Attic intake vent: 1” profile, net free vent area: 6.75 s.i./l.f.

## 2.5 ACCESSORIES

A. Fasteners: In strict accordance to manufacturer’s requirements and recommendations for installation. Staples used for fastening shingles only with the approval of the manufacturer.

B. Roofing cement and miscellaneous conforming to manufacturer’s requirements for completed installation

## 2.6 FABRICATION

A. Form flashings to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water.

B. Form eave edge and gable edge flashing to extend minimum 2 inches onto roof

and minimum 0.25 inches below sheathing.

C. Form flashing sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

D. Hem exposed edges of flashings minimum 1/4 inch on underside.

E. Apply bituminous paint on concealed surfaces of flashings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.

C. Verify roof openings are correctly framed.

D. Verify deck surfaces are dry and free of ridges, warps, or voids.

### 3.2 PREPARATION

A. Fill knot holes and surface cracks with latex filler at areas of bonded membrane.

B. Broom clean deck surfaces and underlayment.

### 3.3 INSTALLATION

A. Ice Dam Membrane Installation:
   1. Place edge metal flashings tight with fascia boards. Weather lap joints minimum 2 inches and seal with plastic cement. Secure flange with nails spaced 8 inches on center.
   2. Install ice dam membrane parallel with eave edge, flush with face of eave edge flashing with edges lapped shingle style and ends lapped and staggered between rows.
   3. Extend ice dam membrane minimum 2 ft up-slope beyond interior face of exterior wall.

B. Underlayment Installation:
   1. Roof Slopes between 2:12 and 4:12: Apply one layer of ice dam membrane over all areas not protected by ice dam membrane at eaves, with end and edges weather lapped minimum of 19 inches. Stagger end laps each consecutive layer. Nail in place.
   2. Roof Slopes 4:12 or Greater: Install one layer of asphalt felt single underlayment perpendicular to slope of roof and lap minimum 4 inches over eave protection.
   3. Place one ply of underlayment over substrate [not covered by ice dam membrane, with ends and edges weather lapped 2 inches Stagger end laps of each consecutive layer. Weather lap ice dam membrane minimum 2 inches. Nail underlayment in place.
   4. Install underlayment in accordance with manufacturer’s instructions. Nail

underlayment overlap at 36 inches on center.

5. Weather lap and seal items projecting through or mounted on roof watertight with plastic cement. Avoid contact or solvent-based cements with ice dam membrane.

C. Valley Protection Installation:
   1. Ice Dam Membrane – Open Valley with W Flashing:
      a. Place one ply of ice dam membrane, minimum 36 inches wide, centered over valleys. Lap joints minimum of 6 inches. Follow instructions of shingle and waterproofing membrane manufacturer.
      b. At Open Valleys: Install one layer of sheet metal W flashing, minimum 24 inches wide, centered over open valley and crimped to guide water. Follow instructions of shingle and waterproofing membrane manufacturer.

D. Base Sheet: Install in strict compliance with manufacturer's instructions. In general:
   1. Place one ply of base sheet over area to be roofed with ends and edges weather lapped minimum 6" on edges and 12" on ends. Stagger end laps of each consecutive layer. Nail in place.
   2. Install base sheet nailed sufficiently to hold in place.
   3. Turn sheet up intersecting walls and rakes in preparation for step or roof-to-wall metal flashings.
   4. Valleys to receive extra 36" width of base sheet over initial base sheet layer.
   5. Weather lap items projecting through or mounted on roof and seal watertight with plastic cement.

E. Metal Flashing:
   1. Apply bituminous paint on concealed surfaces of flashings.
   2. Weather lap joints minimum 4" and seal weather tight with plastic cement.
   3. Secure in place with nails at 8" o.c. Conceal fastening.
   4. Flash and seal work projecting through or mounted on roofing with plastic cement and make weather tight.
   5. Place edge metal under base sheet at eaves (gutters) and over base sheet at rake.

F. Asphalt Shingles:
   1. Install shingles in strict compliance with manufacturer's instructions. In general:
   2. Place shingles in straight coursing pattern with recommended (5") weather exposure to produce double thickness over full roof area. Provide triple course of shingles at eaves.
   3. Project first course of shingles 1/8" beyond edge metal.
   4. Extend shingles 1/8" beyond face of gable edge metal.
   5. Cap hips and ridges with individual shingles, maintaining recommended weather exposure.
   6. Valleys to be closed valleys. Follow manufacturer's instructions.
   7. Where projections extend through roof surface, install flashing with 4" minimum continuous flange; nail to manufacturer's directions. Seal with collar of flashing compound around base prior to and after application of

shingles.

8. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashings.
9. Complete installation to provide weather tight service.
10. Nailing shall follow manufacturer's printed instructions, 4 per 3-tab shingle. No over-driven or under-driven fasteners allowed.
11. Stapling or power stapling is discouraged, and allowed only if permitted by manufacturer.

G. Ridge and Intake vents: Install in accordance with manufacturer's printed instructions.

H. Fall arrest/fall restraint system: Install fall arrest/restraint system according to manufacturer's written instructions. Secure roof top tie down strap through structural plywood deck and into dimensional lumber rafter with 8 each (4 each side) 16d Ardos/Spiral nails driven in at an angle to ensure proper penetration.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Before Substantial Completion, inspect roof to verify shingles self-sealed from exposure to prevent wind uplift. Apply plastic cement to secure shingles that failed to seal. Report results of inspection and required corrective measures.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over finished roof surface.

3.6 WASTE MANAGEMENT

A. Per the Evergreen Sustainable Development Standard, this project is required to divert 75% of all waste from the landfill.

B. Separate waste in accordance with Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

C. Where possible, give preference to suppliers who take back waste for re-use or recycling.

D. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

E. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

F. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

G. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 45 00

# RAINSCREEN SYSTEM

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes rainscreen materials and installation, for placement behind exterior siding materials. Includes fasteners and accessory products.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives, and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 06 20 00 – Finish Carpentry.
3. Section 06 30 00 – Wood Treatment
4. Section 07 21 13 – Board Insulation.
5. Section 07 27 00 – Weather Resistive Barriers.
6. Section 07 46 00 – Fiber Cement Siding.
7. Section 07 62 00 – Sheet Metal Flashing and Trim.
8. Section 07 65 00 – Flexible Flashings.
9. Section 07 90 00 – Joint Protection.
10. Section 08 53 00 – Plastic (PVC) Windows.

### 1.2 REFERENCES

A. American Wood-Preservers' Association:
1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

B. ASTM International:
1. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653 - Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
3. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

5. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. National Institute of Standards and Technology: NIST PS 20 - American Softwood Lumber Standard.

E. National Lumber Grades Authority: NLGA - Standard Grading Rules for Canadian Lumber.

F. Northeastern Lumber Manufacturers Association: NELMA - Standard Grading Rules for Northeastern Lumber.

G. The Redwood Inspection Service: RIS - Standard Specifications for Grades of California Redwood Lumber.

H. Southern Pine Inspection Bureau: SPIB - Standard Grading Rules for Southern Pine Lumber.

I. Underwriters Laboratories Inc.: UL 723 - Tests for Surface Burning Characteristics of Building Materials.

J. West Coast Lumber Inspection Bureau: WCLIB - Standard Grading Rules for West Coast Lumber.

K. Western Wood Products Association: WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data for furring (strapping) materials, fasteners, cavity ventilation products, etc. if different than those specified.

C. Product Data: Submit technical data for field-applied wood preservative materials, and application instructions.

D. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

E. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted, or recovered within 500 miles of the project site.

F. Provide certification from manufacturer verifying the location of the fabricator for products of this Section. Include mailing address and phone number. Provide list of recovered or recycled steel within 500 miles of project site.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by NIST PS 20.
2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.

B. Surface Burning Characteristics: Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect materials from exposure to moisture prior to installation.

PART 2 PRODUCTS

2.1 FURRING/STRAPPING MATERIALS

A. Refer to the drawings for furring materials, location, and orientation (horizontal or vertical).

B. Wood, vertical orientation:
1. Lap and panel siding: 3/4" pressure treated CDX softwood plywood, ripped into 4” wide strips or 1x4 pressure treated softwood lumber without knotholes, checks or cracks (No.1 grade or better). Spacing of furring at maximum 16" centers, aligned with solid wood framing. Larger sizes might be required at specific locations identified on drawings.

C. Substitutions: according to Section 01 25 13 – Product Substitution Procedures.

2.2 ATTACHMENT TO SUBSTRATE FRAMING

A. Fasteners for wood furring:
1. For sodium borate treated furring: Hot-dipped galvanized nails or screws (ZMAX with a G185 coating per ASTM A653, or G90 coating per same standard). Also acceptable epoxy coated screws or nails.
2. For ACQ treated furring: Stainless steel (Types 304 or 316).
3. Size to achieve embedment listed below. Spacing of fasteners 12" centers.

B. Fasteners into substrates other than wood framing (CMU, concrete): ¼" drilled-in rawl pins, stainless steel (Types 304 or 316) for ACQ treated furring. Spacing of fasteners 16" centers.

C. Fastener embedment: 3/4" minimum into solid wood substrate framing, unless otherwise specifically allowed in writing by the manufacturer of the siding material.

2.3 ACCESSORIES

A. Cavity ventilation:
1. Insect screening, 7/16" thick x continuous length.
3. Place product at top and bottom of furring cavity as shown on the drawings and further specified below.

B. WRB, drainage plane, air barrier: refer to Section 07 27 00 - Air Barriers and Water-Resistive Barriers.

2.4 FACTORY WOOD TREATMENT

A. Wood or Plywood, preferred treatment: Water borne preservative treatment for lumber and plywood in conditions not subject to soil, weather, and/or continuous

water contact to be sodium borate treatment, AWPA C31 for lumber and C9 for plywood.

B. Alternate treatment: ACQ preservative treatment. Note that stainless steel fasteners (Types 304 or 316) would be required if this method is selected.

C. Moisture Content After Treatment: Kiln dried (KDAT).
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

## PART 3 EXECUTION

### 3.1 PREPARATION

A. Verify adequacy of backing/blocking and support framing.

B Locate and mark solid wood framing (studs) behind sheathing materials so that furring members can be fastened directly to solid framing.

### 3.2 FURRING/STRAPPING INSTALLATION

A. Set furring members level if horizontal orientation, and plumb if vertical orientation, in correct position for subsequent attachment of siding materials.

B. Locate and install vertical furring directly over framing members, or as otherwise noted on the drawings. Note that at certain locations the drawings may indicate that additional furring is placed between the standard spacings.

C. Fasteners shall penetrate solid wood framing, unless otherwise indicated on the drawings or as otherwise allowed by the siding manufacturer and approved by the Architect. Owner may employ a Special Inspector to confirm that fasteners are driven only into solid wood framing.

D. Gap furring members at floor lines and at thru-wall flashings. Refer to details on the drawings.

E. For metal hat channel furring applications, where the furring is oriented horizontally, shim each fastener with a 1/8" minimum thick horseshoe plastic shim. Place the shim directly behind the fastener to enable water drainage behind the hat channel. Under each shim place a 3x3 inch square of self-adhering membrane (SAM) to preserve the air barrier at the fastener penetration. Drive fastener tight so that shim is held in place.

### 3.3 VENTILATION AND SCREENING

A. Install vent product at the top and bottom of each cavity. Install in long lengths and in continuous fashion without gaps.

B. Fasten with galvanized roofing nails with penetration into solid framing or plywood sheathing. Drive fasteners such that product is not dented or deformed.

C. Install with insect screening facing toward the ventilation cavity (facing down at the top of the cavity and facing up at the bottom of the cavity) according to the manufacturer's instructions.

3.4 SITE APPLIED WOOD TREATMENT

A. Site-apply preservative treatment to cut ends of boards, or cut edges of plywood, only of the factory preservative treatment does not penetrate fully into the stock.

B. Brush-apply two coats of preservative treatment on wood or plywood edges after site cutting.

C. Allow preservative to dry prior to installing members.

3.5 QUALITY ASSURANCE

A. Moisture Content: take moisture readings of lumber and/or plywood furring prior to installation.

3.6 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Furring members: 1/4" from indicated position, maximum.

3.7 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 46 00

# FIBER-CEMENT SIDING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes:
   1. Exterior lap siding for walls, related trim, fascia, flashings, accessories and fastenings.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

D. Performance Requirements:
   1. Durable, paintable, water shedding siding.
   2. The Owner has established environmental goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

E. Project Specific Requirements: None.

F. Related Sections:
   1. Section 06 10 00 – Rough Carpentry.
   2. Section 07 45-00 – Rainscreen System.
   3. Section 07 62 00 – Sheet Metal Flashing and Trim.
   4. Section 07 90 00 – Joint Protection.
   5. Section 09 90 00 – Painting and Coating.

### 1.2 REFERENCES

A. American Hardboard Association: AHA A135.6 - Hardboard Siding.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, and accessories.

C. Fasteners: Submit manufacturer's printed criteria specifically addressing the penetration of fasteners into substrate materials (plywood sheathing vs. solid framing) beneath the siding, including depth of penetration.

D. Samples: Submit two samples 12 x 12 inch in size illustrating surface texture and finish.

E. MSDS Materials: Include material safety and data sheets for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

F. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Provide installer with not less than three years of experience with products similar to those specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store products off the ground, on a flat surface, under a roof or separate waterproof covering, and in ventilated areas with constant minimum temperature according to manufacturer's printed requirements.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish manufacturer’s standard warranty for new siding products.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

A. Refer to drawings for location of each siding type.

B. Listed Manufacturer and Product: James Hardie Building Products, Inc.

C. Other Manufacturers accepted:
1. Substitutions: Section 01 25 13 - Product Requirements.

D. **Siding Type 1**: HardiePlank HZ10 Lap Siding, smooth surface, factory primed for field finishing. Lap exposure of 6 inches, 5/16” thick planks in 12-foot lengths. See drawings for locations. Nails as recommended by manufacturer.

E. **Siding Type 2:** HardiePlank HZ10 Lap Siding, smooth surface, factory primed for field finishing. Lap exposure of 4 inches, 5/16” thick planks in 12-foot lengths. See drawings for locations. Nails as recommended by manufacturer.

2.2 RAINSCREEN SYSTEM

A. Refer to Section 07 45 00.

2.3 ACCESSORIES

A. Wood Framing Fasteners: hot-dipped galvanized or stainless steel fasteners meeting manufacturer’s requirements per the siding manufacturer in printed instructions.

B. Screws: Exposed fasteners, SFS Torx, 1.5”, #10 or 12 self-tapping, stainless steel with a 0.472” dia. head.

C. Nails: James Hardie proprietary unobtrusive finishing nail, of size (depth of penetration) and strength to securely and rigidly retain the work and as required

by the siding manufacturer in printed instructions.

D. Weather Resistive Barrier: refer to Section 07 27 00.

E. Flashing: refer to Section 07 62 00.
   1. Provide flashing behind all butt joints in siding.

F. Prime/Paint: See Section 09 90 00 for field painting.
   1. Factory primed by James Hardie.

G. Soffit Panels: HardieSoffit HZ10 non-vented soffit panel, as manufactured by James Hardie Building Products, Inc.
   1. Factory sealed on 5 sides.
   2. Thickness: 1/5 inch.
   3. Type 1: Smooth non-vented, 16 inches by 12 feet.
   4. Type 2: Smooth non-vented, 24 inches by 8 feet.

H. Trim: Primed SPF S1S2E – sizes and locations as indicated on drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify framing, substrate surfaces, rainscreen furring, and wall openings, and weather-resistive barrier are installed and ready to receive work.

### 3.2 INSTALLATION

A. Strictly comply with manufacturer's printed installation instructions, including nail size and spacing, nail penetration into solid wood or sheathing backing, nail head penetration into siding material, and the like.

B. If fasteners penetrate through rainscreen furring and into plywood sheathing, and not solid framing, confirm with siding manufacturer that this is acceptable practice.

C. Install metal flashings at wall edges, penetrations and openings as detailed. Install specified inside and outside corners as detailed.

D. Face nail panels according to manufacturer's instructions.

E. Position vertical reveals over rainscreen furring strips. Nail the flange of the T-Piece directly to a furring strip.

### 3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

### 3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From plumb and level: 1/4 inch per 10 feet.

C. Maximum Offset From Joint Alignment: 1/16 inch.

3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. See section 01 74 19.

END OF SECTION

# SECTION 07 62 00

# SHEET METAL FLASHING AND TRIM

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes flashings and counterflashings, reglets, and fabricated sheet metal items as indicated on the drawings.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 07 53 03 – Membrane Roofing.
3. Section 07 71 00 – Roof Specialties.
4. Section 07 90 00 – Joint Protection.
5. Section 07 71 23 – Manufactured Gutters and Downspouts.
6. Section 07 90 00 – Joint Protection.
7. Section 09 90 00 – Painting and Coating.

### 1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
1. ASTM A167 – Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

3. ASTM A625/A625M - Standard Specification for Tin Mill Products, Black Plate, Single Reduced.
4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
6. ASTM B32 - Standard Specification for Solder Metal.
7. ASTM B101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
10. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
11. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
12. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
13. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Copper Development Association Inc.: CDA - Copper in Architecture - Handbook.

D. Federal Specification Unit: FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

1.3 QUALITY ASSURANCE

A. Sheet Metal and Air Conditioning Contractors: SMACNA - Architectural Sheet Metal Manual. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples: Submit four samples 4"x4" in size illustrating metal finish color.

E. VOC limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

1.5 QUALIFICATIONS

Fabricator and Installer: Company specializing in sheet metal work with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 WARRANTY

A. Work of this Section is subject to two-year warranty. Provide manufacturer's standard warranty on factory finished metal products for resistance to color change, chalk, fade and corrosion.

B. Provide fabricator/installer's two-year warranty against defective materials and workmanship. Warranty to cover repair or replacement of work of this Section plus associated building materials, without additional cost to Owner, for water damage resulting from failures of products or installations of work of this Section.

1.8 COORDINATION

Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Galvanized Steel Sheet: ASTM A653 prime commercial quality steel sheet, G90 zinc coating (1.25 oz. per sf); 24 gauge core steel unless otherwise noted, shop pre-coated with three coat fluoropolymer finish; color as selected by Architect from manufacturer's standard color chart.

B. Stainless Steel: ASTM A240/240M; Type 302/304, dead soft fully annealed, 0.018 inch thick; smooth surface, Number 2D (matte, non-reflective) finish.

C. Pre-Primed sheet metal: Galvanized and bonderized sheet steel, 24 gauge unless otherwise noted, ready for field painting.

D. Gutters and downspouts: refer to Section 07 71 23.

2.2 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Sealant: Sealant specified in Section 07 90 00.

C. Plastic Cement: ASTM D4586, Type I.

D. Reglets: Surface mounted type, 24 ga. galvanized steel manufactured by Fry Reglet Corp., Springlock flashing system, Type SM for surface mounted applications, field painted.

E. Solder: ASTM B32; type suitable for application and material being soldered.

2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths, allowing for temperature-related expansion and contraction.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18-inch long legs; solder for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip, or as otherwise detailed on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.

C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Insert flashings into reglets to form tight fit.

B. Secure flashings in place using concealed fasteners wherever possible. Use exposed fasteners only where permitted or shown on drawings.

C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Treat any contact surfaces of dissimilar metals to prevent electrolytic corrosion.

E. Fabricate and install with shapes true to line, corners square and sharp, and edges hemmed and neat. Torch cutting not allowed. Surfaces to be free of waves and buckles.

F. Allow for thermal expansion and contraction in accordance with Manual. Runs typically 30 feet maximum.

G. Make exterior work watertight.

3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

3.5 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION

# SECTION 07 65 00

# FLEXIBLE FLASHINGS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Work includes but is not limited to flexible membrane flashings installed at metal flashings, door and window openings, and at other exterior locations where detailed to eliminate water infiltration. Also included is membrane waterproofing installed at coping and flashing areas subject to sustained high temperatures under normal conditions of use.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

F. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 07 27 00 – Weather Resistive Barriers.
3. Section 07 45 00 – Rainscreen System.
4. Section 07 46 00 – Fiber Cement Siding.
5. Section 07 62 00 – Sheet Metal Flashing and Trim.
6. Section 08 53 00 – Plastic (PVC) Windows.

### 1.2 REFERENCES

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

ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers-Tension.

ASTM D 570 – Standard Test Method for Water Absorption of Plastics.

ASTM D 779 – Standard Test Method for Water Resistance of Paper, Paper Board and Other Sheet Materials by the Dry Indicator Method.

ASTM D 828 – Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus.

ASTM D 903 – Standard Test Method for Peel of Stripping Strength of Adhesive Bonds.

ASTM D 1004 – Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

ASTM D1876 – Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).

ASTM D 1938 – Standard Test Method for Tear-Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.

ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
ASTM D 3767 – Standard Practice for Rubber-Measurement of Dimensions.
ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
ASTM E 2112 – Standard Practice for Installation of Exterior Windows, Doors and Skylights.

B. National Roofing Contractor's Association (NRCA): - the NRCA Waterproofing and Damproofing Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Manufacturer’s product literature for each product type, including specification data showing compliance with performance criteria listed.

C. Manufacturer’s written installation instructions. Required to be on file in Contractor’s field office during period of installation.

D. Samples: submit 12”x12” samples of each product type, or other size necessary to show manufacturer’s standard product stamp on the sample.

E. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

1.4 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in waterproof sheet membranes with minimum 3 years experience.

B. Applicator: Company or individual specializing in performing work of this Section with minimum 3 years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Deliver in original labeled packages.

C. Store in clean dry place. Maintain ambient temperatures within limits recommended by the manufacturer before and during application and until liquid or mastic accessories have cured.

D. Handle carefully to avoid damage to product.

1.6 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for waterproofing failing to resist penetration of water.

C. For warranty repair work, remove and replace materials concealing waterproofing.

## PART 2 PRODUCTS

### 2.1 FLEXIBLE FLASHING

A. Listed manufacturer and product: 3M, All Weather Flashing Tape 8067.

B. Other manufacturers:
   1. Substitutions: Section 01 25 13 – Product Substitution Procedures.

D. Properties:
   1. 9.9-mil thick self-sealing and self-healing, fully adhered flexible flashing. Cold applied.
   2. Proprietary film with acrylic adhesive and heavy paper liner.
   4. Provide in 9” minimum width strips for application around window and door openings, and other flashing areas.

E. Surface conditioner, by manufacturer of membrane product, for conditioning of wall surface prior to the application of flashing sheets. Refer to manufacturer’s printed instructions for specific substrate materials or environmental conditions requiring application of surface conditioner.

## PART 3 EXECUTION

### 3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### 3.2 INSTALLATION

A. In general, strictly comply with manufacturer’s written installation instructions for all proprietary products.

B. Carefully and accurately lay out, cut, fit, and install to detail.

C. Install products weather-fashion, facilitating the passage of water or moisture toward drainage paths or weep holes as detailed.

D. Refer to detailed application sequence shown on the drawings.

E. Surface to receive flashing must be smooth, clean, dry, and free of voids, spalls, loose substrates, and protrusions. Clean the substrate by wiping with a clean dry cloth or brush.

### 3.3 INSTALLATION OF FLEXIBLE FLASHING STRIPS

A. Comply with the installation sequence shown on the drawings.

B. Observe environmental limitations of the manufacturer. Apply strip flashings in fair weather when the air, surface and membrane temperatures are 40 degrees F or higher. Apply covering materials at 40 degrees F or higher.

C. Apply surface conditioner in strict compliance with the manufacturer’s written instructions.

D. Cut flashing into easily handled lengths. Peel release paper from roll to expose adhesive surface and carefully position flashing against substrate. Press firmly

into place with a steel hand roller, fully adhering the flashing to the substrate to prevent water migrating under the flashing. Overlap adjacent pieces 3” minimum and roll overlap with the roller.

E. Install a flexible flashing strip behind all attachments to the building where a fastener will penetrate the weather-resistant barrier. This includes attachments for masonry veneer ties, fasteners for rigid insulation, clips or channels for metal panels or siding products, and the like. Strip shall be large enough to project outside the base dimension of the fastened object, or if the object is linear the strip shall be continuous for the entire length and width of the object.

F. Apply at all inside and outside corners over the water-resistive barrier, under trim products.

G. If wrinkles or fishmouths develop, follow manufacturer’s recommendations for cutting and remedying. Alternately, remove and reapply a new strip.

H. Do not leave flashing strips permanently exposed to sunlight. Do not exceed the maximum recommended exposure time stated by the manufacturer.

I. Protect the flashing from damage after installation. Cover to protect from exposure to sunlight, according to the manufacturer’s stated time limit.

## 3.4 INSTALLATION OF HIGH-TEMP MEMBRANES

A. In all cases, follow manufacturer's printed instructions.

B. Roll out membrane. Minimize wrinkles and bubbles.

C. Remove release paper layer. Roll out on substrate with mechanical roller to encourage full contact bond.

D. Lap sides and ends.

E. Overlap edges and ends minimum 3 inches. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.

## 3.5 FIELD QUALITY CONTROL

A. Notify manufacturer’s representative prior to the start of work, and make arrangements for representative to be present during the pre-installation conference. Representative to verify that work is being conducted in accordance with manufacturer’s instructions.

B. Manufacturer’s representative is required to inspect the finished work prior to covering, and confirm that manufacturer’s instructions have been observed.

C. Verify that proper dimensions for vertical and horizontal laps have been observed.

D. Cover any product that remains exposed to sunlight within the time limitations required by the manufacturer.

E. Remedy any flashings that have become dislodged during the work, or have become loose from the substrate material or dog-eared at corners.

## 3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should

be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 71 23

# MANUFACTURED GUTTERS AND DOWNSPOUTS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes pre-finished aluminum gutters and downspouts.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 07 46 00 – Fiber Cement Siding.
2. Section 07 62 00 – Sheet Metal Flashing and Trim.
3. Section 07 90 00 – Joint Protection.

### 1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4. ASTM B32 - Standard Specification for Solder Metal.
5. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

6. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

C. Copper Development Association Inc.: CDA - Copper in Architecture - Handbook.

D. Federal Specification Unit: FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

E. Sheet Metal and Air Conditioning Contractors: SMACNA - Architectural Sheet Metal Manual

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on manufactured components, materials, and finishes.

C. Samples: Submit four samples, 8"x10" illustrating component color and finish.

1.4 QUALITY ASSURANCE

Perform Work in accordance with SMACNA Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

1.6 WARRANTY

Furnish five-year manufacturer warranty for gutter and downspout finishes.

PART 2 PRODUCTS

2.1 GUTTERS AND DOWNSPOUTS

A. Gutters: 5-inch K-style prefinished aluminum, continuous gutter complete with end pieces, outlet tubes, and other accessories as required. Fabricate on site with no seams. Fabricate gutter accessories from same metal as gutters

B. Downspouts: Prefinished aluminum sheet, extruded to rectangular 2"x4" nominal size complete with front and side elbows.

2.2 COMPONENTS

A. Pre-Finished Aluminum Sheet: ASTM B209, manufacturer’s standard alloy and temper for specified finish; 0.040 inch thick; smooth finish, shop pre-coated with PVDF (polyvinylidene fluoride) coating; color as selected by Owner from manufacturer's standard color line.

2.3 ACCESSORIES

A. Connectors: Manufacturer's standard, same material as gutter and downspout.

B. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with SMACNA requirements. For aluminum, type recommended by fabricator.
   2. Gutter Supports: Aluminum quick screw hangers.
   3. Downspout Supports: Straps.

C. Fasteners: Prefinished steel or aluminum 3-inch hex head screws with soft neoprene washers.

2.4 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated.

B. Fabricate with required connection pieces.

C. Form sections to shape indicated, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate downspouts with a turn-out at the bottom. Seal watertight to downspout body.

F. Fabricate gutter and downspout accessories; seal watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive gutters and downspouts.

3.2 INSTALLATION

A. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

B. Attach gutters at eave to firmly anchored gutter not more that 24-inches apart.

C. Slope gutters sufficiently to assure positive drainage toward outlet at downspout – minimum 1/4" per foot.

D. Join downspout sections with 1-1/2” telescoping joints. Provide hex head screws to securely strap to building and downspouts; locate fasteners at top and bottom and at 60-inches on center in between.

E. Attach downspouts to wall so that bottom turn-out is 6" above splash block.

F. Connect to existing storm lines. Tight lines to downspouts are to be excavated and moved as necessary to accommodate additional siding assembly thickness at cornerboard locations.

3.3 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 07 84 00

# FIRESTOPPING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes firestopping materials and accessories; firestopping tops of fire rated walls.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 13 for additional requirements.

C. Related Sections:
   1. Section 07 26 00 - Vapor Barriers and Vapor Retarders.
   2. Section 09 21 16 - Gypsum Board Assemblies.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. Intertek Testing Services (Warnock Hersey Listed): WH - Certification Listings.

C. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

### 1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

### 1.4 PERFORMANCE REQUIREMENTS

A. Conform to IBC, FM, or UL standards for fire resistance ratings and surface burning characteristics as referenced in the drawings or these Specifications.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

G. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant installed inside the weather resistive barrier (WRB) used in this Section identifying VOC limits and chemical components.

1.6 QUALITY ASSURANCE

A. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience and approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F, or as otherwise indicated in manufacturer's instructions. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Hilti Corp.
3. 3M fire Protection Products.
4. Pecora Corporation.
5. United States Gypsum Co.
6. Substitutions: Section 01 25 13 – Product Substitution Procedures.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.
8. Mortar as specified in Section 04 05 03 where permitted by applicable code.

C. VOC Limits: Refer to Section 01 81 13.

2.2 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent: As recommended by firestopping manufacturer.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 LOCATIONS

A. Joints around fenestration and door frames.

B. Junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels.

C. Openings at penetrations of utility services through roof, walls, and floors.

D. Site-built fenestration and doors.

E. Building assemblies used as ducts or plenums.

F. Joints, seams and penetrations of vapor retarders.

G. All other openings in the building envelope.

3.2 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive firestopping.

C. Verify acceptability of all firestopping products and application methods with the building and fire department inspectors prior to installation of any work.

3.3 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials if required to arrest liquid material leakage.

3.4 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Refer to Section 01 74 19 for specific requirements.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

# SECTION 07 90 00

# JOINT PROTECTION

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes sealants and joint backing, and accessories.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 41 00 – Architectural Wood Casework.
2. Section 06 61 16 – Solid Surface Countertops.
3. Section 07 27 00 – Weather Resistive Barriers.
4. Section 07 46 00 – Fiber Cement Siding.
5. Section 08 16 13 – Fiberglass Doors.
6. Section 08 53 00 – Plastic (PVC) Windows.
7. Section 09 21 16 – Gypsum Board Assemblies: Acoustic sealant.
8. Section 10 60 00 – Interior and Exterior Specialties: Tub surrounds.
9. Section 12 35 30 – Casework

### 1.2 REFERENCE

A. ASTM International:
1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
5. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
6. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
7. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit four samples, manufacturer's standard sample card illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants that do not cure.

F. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Applicator: Company or individual specializing in performing Work of this section with minimum three years experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Listed Manufacturers:
   1. Tremco Commercial Sealants and Waterproofing.
   2. Dow Corning Corp.

B. Other Manufacturers:
   1. BASF Sonolastic.
   2. GE Silicones.
   3. OSI
   4. Pecora Corp.
   5. Sika Corp.
   6. Bostik, Inc.
   7. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

D. Stain Characteristics: Provide elastomeric joint sealant products that are non-staining to porous substrates and have undergone testing according to ASTM C1248 and have not stained porous substrate materials indicated for this project.

E. Colors: As selected by the Architect from the manufacturer's full line of standard colors.

F. VOC Limits: All interior and exterior Products must comply with VOC limits outlined in Bay Area Air Quality Management District Regulation 8, Rule 51.

G. Products Description:

1. High Performance General Purpose Exterior Non-traffic Sealant:
    a. Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
    b. Applications: Use for:
        1) Control, expansion, and soft joints in masonry.
        2) Joints between concrete and other materials.
        3) Joints between metal frames and other materials.
        4) Other exterior non-traffic joints for which no other sealant is indicated.
2. General Purpose Traffic Bearing Sealant:
    a. Polyurethane; ASTM C920, Grade P, Class 25, Use T; single component.
    b. Applications: Use for exterior and interior pedestrian and vehicular traffic bearing joints.
3. Exterior General Purpose Non-traffic Sealant:
    a. Silicone ultra-low modulus; ASTM C 920, Type S, Grade NS, Use NT; joint movement range 100% in extension and 50% in compression.
    b. Applications: Joints in concrete, masonry, metals, metal door and metal window frames.
4. Exterior between laps of Water-Resistant Barrier: Refer to Section 07 27 00.
5. Exterior General Purpose Non-traffic Sealant: BASF MasterSeal NP 150 or OSI Quad Max.
    a. Hybrid polymer; ASTM C920, Type S, Grade NS, Class 50, Use NT.
    b. Applications: Vinyl nail flange windows, fiber cement siding to trim, trim to vinyl window frames.
6. Exterior Compressible Gasket Expansion Joint Sealer:
    a. ASTM D2628, hollow neoprene (polychloroprene) compression gasket.
    b. Size and Shape: As indicated on Drawings.
    c. Applications: Use for exterior wall expansion joints.
7. Exterior Metal Lap Joint Sealant:
    a. Butyl or polyisobutylene, non-drying, non-skinning, non-curing.

b. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.

8. General Purpose Interior Sealant:
   a. Acrylic emulsion latex; ASTM C834, single component, paintable.
   b. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
9. Interior Air Barrier Sealant: Dow Corning 758 Silicone Building Sealant.
   a. Silicone ultra-low modulus; ASTM C 920, Type S, Grade NS, Use NT; joint movement range 100% in extension and 50% in compression.
   b. Applications: vinyl nail flange window frames.
10. Wet Areas Sealant:
   a. White silicone; ASTM C920, Uses M and A; single component, mildew resistant.
   b. Applications: Use for joints between plumbing fixtures and floor and wall surfaces, and joints between kitchen and bathroom or toilet room counter tops and wall surfaces.
11. Acoustical Sealant: Butyl or acrylic sealant;
   a. ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
   b. Applications: Use for concealed locations only at acoustically rated construction. Provide sealant bead between top stud runner and structure and between bottom stud track and floor.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber or D1667, closed cell PVC, type acceptable to sealant manufacturer; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints per manufacturer's requirements.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated, or otherwise recommended by the sealant manufacturer:
   1. Width/depth ratio of 2: 1.
   2. Neck dimension no greater than 1/2 of joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

H. Sanded joints in masonry work: After sealant has been placed in joint, and prior to skinning of sealant surface, broadcast fine sand onto the sealant surface to mimic adjacent mortar joints. Use only if joint is exposed to view in the finished work.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

3.6 AIR SEAL LOCATIONS

A. Joints around fenestration and door jambs;

B. Junctions between wall and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels;

C. Openings at penetrations of utility services through roofs, walls and floors;

D. Site-built fenestration and doors;
E. Building assemblies used as ducts or plenums;
F. Joint, seams and penetrations of vapor retarders;
G. All other openings in the building envelope;
H. Seal at recessed light fixtures;
I. Seal at electrical panels, electrical boxes, data boxes;
J. Install caulk at top and bottom plates of exterior walls;
K. Seal between the bottom plate and subflooring;
L. Seal drywall at the intersection of the drywall and top/bottom plate;
M. Seal penetrations through the top and bottom plates from plumbing, wiring, and ducts;
N. Caulk interior window jambs;
O. Fill rough opening of windows and doors with backer rod and caulk;
P. Caulk at window and door trim to drywall;
Q. Seal at the junction between the ceiling and walls.

3.7 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.
B. Where possible, give preference to suppliers who take back waste for re-use or recycling.
C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.
D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.
E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.
F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 08 16 00

# MOLDED COMPOSITE DOORS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes:
   1. Interior Molded Doors.

B. Related Sections:
   1. Section 06 20 00 Finish Carpentry.
   2. Section 08 16 13 Fiberglass and Wood Doors.
   3. Section 08 71 00 Door Hardware.

### 1.2 REFERENCES

### 1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit door manufacturer current product literature, including installation instruction.

C. Samples: Provide finish samples for all products.

D. Quality Assurance Submittals
   1. Manufacturer Instructions: Provide manufacturer's written installation instructions.

E. Closeout Submittals
   1. Refer to Section 01 70 00 Closeout Requirements.

### 1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 60 00 Product Requirements.

B. Deliver doors, materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store doors as recommended by manufacturer.

### 1.5 WARRANTY

A. Manufacturer standard 5-year warranty indicating that the door will be free from material and workmanship defects from the date of substantial completion each building.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

A. JELD-WEN® Interior Doors; 3305 Lakeport Blvd; Klamath Falls, OR 97601, USA; Phone 877.535.3462, fax 541.882.3455; website www.jeld-wen.com.

B. Substitutions: Section 01 25 13 _ Product Substitution Procedures.

C. Product: Basis of Design:
   1. Types B1, C1, D1, D2: JELD-WEN®'s Molded Wood Composite Interior Doors; Woodgrain 6-Panel Pre-hung Interior Door; Primed; Sizes per Door Schedule
   2. Types E1, E2, E3, E4: JELD-WEN®'s Molded Interior Doors; Woodgrain 6-Panel Primed Molded Single Interior Door. Sizes per Door Schedule.

2.2 UNIT DOORS (Types B1, C1, D1, D2)

A. Door Design
   1. Surface Finish: Woodgrain
   2. Panels and Sticking Profile: flush: Six panels, with cove and bead
   3. Solid core interior doors with wood frame
      a. Thickness: 1-3/8 inch
   4. Finish: Pre-primed White
   5. Jambs (passage doors only)
      a. Jamb Width: 4-9/16 inch – field verify

2.3 CLOSET DOORS (Types E1, E2, E3, E4)

A. Door Design:
   1. Surface Finish: Woodgrain
   2. Panels and Sticking Profile: Six panels, with cove and bead
   3. Construction: Solid core with MDF frame for interior doors.
   4. Finish: Pre-primed White
   5. Thickness:
      a. Thickness: 1-3/8 inch for passage type doors

PART 3 EXECUTION

3.1 GENERAL

A. Install doors in accordance with manufacturer's installation guidelines and recommendations.

3.2 EXAMINATION

A. Inspect door prior to installation.

B. Inspect rough opening for compliance with door manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.3 PREPARATION

A. Prepare door for installation in accordance with manufacturer's recommendations.

B. Trim bottom of jamb sides to achieve desired distance between door bottom and finished floor height.

3.4 PASSAGE DOOR INSTALLATION

A. Place door unit into opening and level hinge side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.

B. Level latch side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.

C. Verify spacing between jamb and door is uniform on all sides. Adjust as necessary.

D. Shim top of jamb in center of opening and fasten with nail.

E. Re-check for square, level and even spacing around door. Nail securely in place through stop, jamb, shims and into studs every 12 inches.

F. Set nails.

G. Install trim on both sides using nails every 12 to 16 inches.

3.5 BI-PASS DOOR INSTALLATION

A. Attach door hardware to door.

B. Fasten overhead track in center of finished opening by inserting screws through pre-drilled holes.

C. Install door assemblies.

D. Check positioning and operation. Adjust hardware if necessary.

END OF SECTION

# SECTION 08 16 13

# FIBERGLASS DOORS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Fiberglass reinforced plastic (FRP) doors.
   2. Frames for fiberglass reinforced plastic doors.

B. Related Sections:
   1. Section 06 20 00 Finish Carpentry
   2. Section 08 16 00 Molded Composite Doors
   3. Section 08 71 00 Door Hardware

### 1.2 REFERENCES

A. ASTM International
   1. ASTM E90; Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
   2. ASTM E283; Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
   3. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Pressure Difference
   4. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
   5. ASTM E413; Classification for Rating Sound Insulation (STC).
   6. ASTM E547; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
   7. ASTM E1300; Standard Practice for Determining Load Resistance of Glass in Buildings.
   8. ASTM E1332; Standard Classification for Determination of Outdoor-Indoor Transmission Class.
   9. ASTM E1886; Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
   10. ASTM E2235; Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods.

B. National Fenestration Rating Council (NFRC)
   1. NFRC 100; Procedure for Determining Fenestration Thermal Properties
   2. NFRC 200; Solar Heat Gain Coefficient and Visible Transmittance
   3. NFRC 400; Procedure for Determining Fenestration Product Air Leakage

C. National Fire Protection Association

1. NFPA 252; Standard Methods of Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit door manufacturer current product literature, including installation instruction.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections, anchorage methods and locations, accessories, hardware locations, and installation details.

D. Samples: Provide finish samples for all products.

E. Quality Assurance Submittals
1. Design Data: Provide manufacturer test report numbers indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 60 00 Product Requirements.

B. Deliver doors, materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store doors as recommended by manufacturer.

D. Protect materials and finish during handling and installation to prevent damage.

1.5 WARRANTY

A. Manufacturer standard warranty indicating that doors will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
1. Door System: 25 Years.
2. Frame: Lifetime.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Therma-Tru Corp.; 1750 Indian Wood Circle, Maumee, OH 43537; Phone: (419) 891-7400; www.thermatru.com or equal.

B. Substitutions: Section 01 25 13 Product Substitution Procedures.

C. Product: Basis of Design:
1. Type A1 (Residential Building Entry Doors and Utiility Doors): Therma-Tru Smooth Star, Flush Panel 36" x 80", primed white fiberglass pre-hung exterior front door.
2. Type G1 (Accessible Porch Door): Therma-Tru Smooth Star, Flush Panel 36" x 80", primed white fiberglass pre-hung full lite exterior front door with sidelite.

2.2 MATERIALS

A. Fiberglass Skins: Long Fiber Injection (LFI) Technology, incorporating multiple layers of resins, tinted resins, base colors and reinforcing materials.

B. Stiles and Rails: Engineered wood (laminated veneer lumber).

C. Core: Polyurethane core.

2.3 FIBERGLASS ENTRANCE DOORS (Type A1 and common doors)

A. Door Design:
1. Surface Finish: Smooth
2. Door Style: Flush Panel
3. Construction: Smooth Star solid core with fiberglass facing
4. Finish: Pre-primed White.
5. Thickness: 1-3/4 inch.
6. Glazing: none
7. Frame:
a. Jamb Width: 6-9/16 inch – field verify
b. Jamb Species: Finger-Jointed Pine
8. Hardware: per hardware schedule.
9. Fire Rating: per door schedule.

2.4 FIBERGLASS PATIO DOOR (Type G1)

A. Door Design:
1. Surface Finish: Smooth
2. Door Style: Full Lite Flush Panel with Side Lite
3. Construction: Smooth Star solid core with fiberglass facing
4. Finish: Pre-primed White.
5. Thickness: 1-3/4 inch.
6. Glazing: insulated, Low-E
7. Frame:
a. Jamb Width: 6-9/16 inch – field verify
b. Jamb Species: Finger-Jointed Pine
8. Hardware: per hardware schedule.

2.5 CONSTRUCTION ACCESSORIES

A. Flashing: Refer to Section 07 60 00 Flashing and Sheet Metal.

B. Sealants: Refer to Section 07 92 00 Joint Sealants.

2.6 FABRICATION

A. Skins are adhered to engineered wood frames with core materials and bonding agents that permanently lock skin to frame.

PART 3 EXECUTION

3.1 GENERAL

A. Install doors in accordance with manufacturer’s installation guidelines and recommendations.

3.2 EXAMINATION

A. Inspect door prior to installation.

B. Inspect rough opening for compliance with door manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.3 INSTALLATION

A. Install jamb assembly.
   1. Caulk sill along outside edge and ½ inch in from edge of subfloor.
   2. Set door unit into center of opening and tack in place.
   3. Shim hinge then latch side jambs straight. Inspect jamb for square, level and plumb.

3.4 PROTECTION

A. Protect installed doors from damage.

3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. See section 01 74 19.

END OF SECTION

SECTION 08 53 00

PLASTIC (PVC) WINDOWS AND SLIDING GLASS DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Factory fabricated tubular extruded plastic (PVC) windows in sliding and single hung configurations and glass patio doors. Units to be factory glazed, with integral nailing fin, operating hardware and insect screens.
2. Schedule of windows and sliding glass doors: refer to the drawings.
3. Section includes detailed instructions for installation and air leakage testing of flanged windows.

B. Performance Requirements:
1. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of window.
2. Primary Performance Requirements: windows to meet or exceed performance criteria for ANSI / AAME / NWWDA 101/I.S.2. designation C20 Commercial windows.
3. Uniform Structural Load: Uniform Structural Load Test at 150% of Design Pressure. Test shall be conducted in accordance with ASTM E 330.
4. Assembly: To accommodate without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.
5. Thermal Resistance of Assembly: U-Value of 0.27 or better when measured in accordance with NFRC 100. Solar Heat Gain Coefficient (SHGC) of 0.35 or better.
6. Vapor Seal: No vapor seal failure at lineal static pressure of 1 inch, 72 degrees F, and 40% of relative humidity.
7. Condensation Resistance Factor: CRF of 60* when measured in accordance with AAMA 1503.
8. Water Leakage: None, when measured in accordance with ASTM E 331 at a pressure differential of 15psf in the lab. None, when measured in accordance with field test AAMA 502-08 using a uniform static air pressure difference of (Product rating dp x .15 x .667) psf with a minimum field test pressure differential of 6psf.
9. System internal Drainage: Drain water entering assembly, condensation occurring in glazing channels, or migrating moisture within the system, to the exterior via a weep drainage network.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapor retarder.
11. Thermal Movement: Design sections to permit normal movement caused by thermal expansion and contraction of vinyl members to suit glass, infill, and perimeter opening construction.

12. Design Temperature Range: 120º F.
13. Noise Reduction (NR) rating for acoustic windows: See window schedule for requirements

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry: Wood framed openings.
2. Section 07 27 00 – Weather Resistive Barriers.
3. Section 07 65 00 – Flexible Flashings.
4. Section 07 90 00 – Joint Protection.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA/WDMA/CSA 101/I.S.2/A440 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors; American Architectural Manufacturers Association.
2. AAMA 303 - Voluntary Specification for Poly (Vinyl Chloride) (PVC) Exterior Profile Extrusions.
3. AAMA 501.2-03 – Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
4. AAMA 502-08 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
5. AAMA 503-03 – Voluntary Specification for Field Testing of Storefronts, Curtain Walls and Sloped Glazing Systems.
6. AAMA 511-08 – Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products.
7. AAMA 613 - Voluntary Performance Requirements for Test Procedures for Organic Coatings on Plastic Profiles.
8. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association
9. AAMA/I.S.2/A440-08 – AAMA Gold Label Program: North American Certification Program for Mass Manufactured Products (Harmonized CSA and 101 ANS).

B. American Society of Civil Engineers: ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
1. ASTM C1036 - Specification for Flat Glass.
2. ASTM C1048 - Specification for Heat-Treated Flat Glass - Kind HS, Kind FT - Coated and Uncoated Glass.

3. ASTM D3656 - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
4. ASTM D4726 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.
5. ASTM E1105-00 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtainwalls, by Uniform or Cyclic Static Air Pressure Difference.
6. ASTM E783-02 – Standard Test Method for Field Measurement of Air Leakage Through installed Exterior Windows and Doors.
7. ASTM E2112-07 - Standard practice for Installation of Exterior Windows, Doors and Skylights.
8. ASTM E2128-01a – Standard Guide for Evaluating Water Leakage of Building Walls.
9. ASTM E2099-00(2007) – Standard Practice for the Specification and Evaluation of Pre-Construction Laboratory Mockups of Exterior Wall Systems.
10. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
11. ASTM E330-02 – Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
12. ASTM E331-00 – Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
13. ASTM E547-00 – Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Differential.
14. ASTM F588-07 – Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

D. Glass Association of North America: GANA - Glazing Manual.

E. National Fenestration Rating Council Incorporated: NFRC 100 - Procedures for Determining Fenestration Product U-Factors.

## 1.3 SYSTEM DESCRIPTION

A. Windows: Extruded tubular plastic (PVC) sections, factory fabricated, vision glass, integral nailing flange, related flashings, anchorage and attachment devices.

B. Configuration: Conform to AAMA 101 Designations for fixed and operating sash designs shown on the drawings.

## 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Schedule to indicate:
1. Manufacturer
2. Model number

3. Type
4. Design Pressure Rating
5. U-factor
6. SHGF value
7. CRF Value
8. Size
9. Frame Color
10. Glazing type
11. Vent / no vent
12. CPD Number

C. Shop Drawings: Submit window schedule indicating each unit size, rough-opening dimensions, framed opening tolerances, affected related work, location of fresh air port(s) and installation requirements.

D. Product Data: Submit component dimensions, anchorage and fasteners, glass, internal drainage, and typical details.

E. Samples: Submit two window and frame sections, 12 x 12 inch in size, illustrating window frame section, mullion section, screen and frame, and finished surfaces

F. Manufacturer's Certificates: Certify Product performance ratings by NFRC as meeting or exceeding specified requirements.

G. Energy compliance labels: refer to paragraph 3.5 below.

H. VOC Limits: Include manufacturer’s data sheets for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Fabricate window assemblies in accordance with AAMA 101 for types of windows required.
2. Insulated Glass: Fabricate insulated glass units in accordance with GANA (formerly FGMA) Glazing Manual.

B. **Wall and Window Installation Mock-Up:** The General Contractor will direct the building of a mock-up wall independent of the building envelope for the Architect and Owner to review with all products and trades included in the window assembly. At the selected mock-up location, all products of the each of the exterior wall assemblies (existing wood frame, windows, metal flashing, self-adhering membranes, air/water barriers, etc.) will be installed and inspected at various stages of installation. Perform the mock-up installations of the entire window assembly. These mock-up locations will be evaluated for constructability and may be tested for weather-tight qualities. Modifications, if any, to the exterior wall assemblies resulting from the mock-up will be discussed, documented by the contractor and incorporated into the work per ESDS-7.13. Contractor to coordinate with mock-up required in Section 07 21 16 Blanket Insulation & 07 21 13 Board Insulation.
1. Subcontractor(s) responsible for the work of this section required to attend.

2. Subcontractor(s) responsible for the work of this section required to supply two typical residential windows, one operable and one fixed, for the mock up.
3. Location to be coordinated with Owner.
4. Provide Owner with one week's notice prior to installation

C. Window testing: refer to the Part 3 Execution portion of this Section.

D. Qualifications:
1. Manufacturer: Company specializing in manufacturing commercial windows with minimum five years experience, and with service facilities within 100 miles of Project.
2. Installer: Company specializing in installation of commercial windows with minimum five years experience, and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver to site in manufacturer's original unopened containers and packaging, with labels clearly identifying manufacturer and product name.

C. Protect flanges and finished surfaces with wrapping and/or boxing. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

D. Jig, brace, and box window frame assemblies for transport to minimize flexing of members and to minimize flexing of joints. Store off ground in a vertical position.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install glazing materials when ambient temperature is above or below manufacturer's stated limits. Maintain this temperature range during and after installation of sealants.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Correct defective Work within a five-year period after Date of Substantial Completion.

C. Furnish ten-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

PART 2 PRODUCTS

2.1 VINYL WINDOWS

A. Manufacturer: Ply Gem Windows, Cary, NC (with offices in Auburn, WA)

B. Other Manufacturers accepted:

1. VPI Quality Windows, Spokane, WA;
2. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Substitutions: Section 01 60 00 – Product Requirements

D. Product Description:
1. Window Types A and B: Ply Gem 200 Pro Sliding, hollow tubular ultra-violet resistant polyvinyl chloride (PVC) window frames with welded corner construction. Configurations of sash as scheduled on the drawings.
2. Window Types C and D: Ply Gem 200 Pro Casment, hollow tubular ultra-violet resistant polyvinyl chloride (PVC) window frames with welded corner construction. Configurations of sash as scheduled on the drawings.

E. All units to be NFRC rated.

## 2.2 VINYL SLIDING PATIO DOOR

A. Manufacturer:
1. Ply Gem Windows, Cary, NC (with offices in Auburn, WA)
2. Substitutions: Section 01 60 00 – Product Requirements

B. Other Manufacturers accepted:
1. VPI Quality Windows, Spokane, WA;
2. Substitutions: Section 01 25 13 – Product Substitution Procedures

C. Product Description: Ply Gem Pro Series 960 Sliding Patio Door, hollow tubular ultra-violet resistant polyvinyl chloride (PVC) window frames with welded corner construction. Configurations of fixed and operable sash as scheduled on the drawings.

D. All units to be NFRC rated.

## 2.3 COMPONENTS

A. Minimum energy conservation requirements: U-value 0.26 or better for entire unit.

B. Insulating Glass: HP2+ sealed double pane units, 3/4" inch thick, Low-E argon filled, conforming to the following.
1. Outer Pane: Clear, Low-E coating, float glass, ASTM C1036, Quality 1.
2. Inner Pane: Clear float glass, Interior Surface Low-E, ASTM C1036, Quality 1.
3. Tempered: Clear, ASTM C 1048.
4. Pane Thickness: ¼”.
5. U-value center of glass: 0.26 (summer daytime) and 0.28 (winter night time).
6. Solar Heat Gain Coefficient (SHGC): 0.27.
7. Visible Light Transmittance: 64%.
8. Locations: All units except those specifically identified on the window schedule(s).

C. Window Frame: Extruded multi-chambered PVC frame with integral ultra-violet degradation resistance, continuous integral nailing fin; depth 3-7/16 inches; nominal wall thickness 0.050 to 0.080 inches; corners mitered and heat welded.

D. Window Hardware: Sash lock: Lever handle with cam lock. Install at factory. Standard crank handles for casement windows, standard handle for awning windows. Locate hardware within 48-inches of finished floor.

E. Window Sills: Tubular; sloped for positive wash; one-piece full width of opening.

F. Operable Sash Weather Stripping: Manufacturer's standard; permanently resilient, profiled to effect weather seal.

G. Patio Door Frame: Extruded multi-chambered PVC frame with integral ultra-violet degradation resistance, continuous integral nailing fin; depth 4-3/8 inches; nominal wall thickness 0.050 to 0.080 inches; corners mitered and fusion welded.

H. Patio Door Hardware: Smooth gliding rollers; two-point lock with adjustable strike. Anodized aluminum threshold cover.

I. Color: White PVC frame and hardware.

J. Insect Screen Frame: manufacturer's standard frame of rectangular sections; nominal size similar to operable glazed unit.

K. Insect Screens: gray color.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard.

2.5 FABRICATION

A. Integral nail flange.

B. Units to be factory assembled and glazed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section. Refer to step-by-step procedure for wrapping rough openings shown on the drawings.

C. Verify that window units are sized as required to provide an open perimeter shim space of not less than ¼" nor more than ½" in any location, or as otherwise required by the manufacturer.

D. Prior to installation, examine each window unit to assure that it is not damaged in any way. Do not install units that are damaged.

3.2 INSTALLATION

A. In general, strictly comply with manufacturer's printed installation instructions. Refer to the drawings for application sequence for products of this Section.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent Work.

D. Prior to installing window, install adjustable sill pan flashing.

E. Insert and center window in opening, adjust as needed to assure unit is completely plumb, level and straight. Operate ventilation sash to assure it operates properly. Fasten unit as shown on the drawings. Do not fasten the head flange except as noted below.

F. For units exceeding 24" width, fasten head flange with fasteners placed through washers approximately 3/8" above tops of nail flanges so that washers hold the flange tight to the sheathing while allowing differential header deflection without imposing building loads to the window.

G. Insert Gutter Guard under the sill flange to promote water drainage under the sill frame. Follow manufacturer's instructions for placement of flange fasteners at the jamb flange and at the sill flange.

H. Proceed with perimeter flashing installation as shown on the drawings.

I. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation, or low-expanding foam insulation, in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Coordinate attachment and seal of perimeter air and vapor retarder materials.

K. Adjust hardware for smooth operation and secure weathertight closure.

## 3.3 WINDOW AIR LEAKAGE TESTING

A. The window assembly shall be tested in accordance with ASTM E783-02 (2010) - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

1. The storage room shall be pressurized to 50 Pascal with respect to the exterior.
2. The installation shall be inspected by the Owner with chemical smoke for air leakage of the window installation. This is not a test of the window but of the window installation. The judgment of success of the test will be the approval of the installation by the Owner.
3. The test shall demonstrate that the assembly is substantially airtight with no significant air leakage pathways identified.
4. The installation and test shall be repeated until a satisfactory standard is attained.
5. The successfully tested assembly shall be the method of installation for all the windows in the project.
6. The Owner may test additional windows during the project to ensure compliance. Coordinate with Owner as necessary.

## 3.4 ERECTION TOLERANCES

A. ADJUSTING Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non- cumulative or 1/8 inches per 10 ft, whichever is less.

## 3.5 REMOVING ENERGY-PERFORMANCE LABELS

A. Remove energy-performance labels from window glass only after the Building Inspector has reviewed and approved the installation.

B. Carefully remove labels, and provide the General Contractor with three undamaged labels from each separate window type (fixed, single-hung, casement, etc.) for the Project Manual to be provided to the Owner.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished surfaces.

C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.7 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. See section 01 74 19.

END OF SECTION

# SECTION 08 71 00

# DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

B. Related Sections:

1. Section 08 16 00 Molded Composite Doors
2. Section 08 16 13 Fiberglass Doors

### 1.2 QUALITY ASSURANCE

A. Product Qualification:

1. To assure a uniform high quality of materials for the project, it is intended that only specified items be furnished. Comparable products may be accepted upon prior approval of architect.
2. Hardware to be new, free of defects, blemishes and excessive play. Obtain each kind of hardware (Mechanical latch and locksets, exit devices, hinges and closers) from one manufacturer except where specified.
3. Fire-Rated opening in compliance with NFPA80. Hardware UL10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved bearing hinges and smoke seal. Furnish openings complete.

B. Supplier Qualifications:

1. Hardware supplier will be a direct factory contract supplier who employs a certified Architectural Hardware Consultant (AHC) available at all reasonable times during the course of the work for project hardware consultation to owner, architect and contractor.
2. Supplier will be responsible for detailing, scheduling and ordering of finish hardware.
3. Conduct pre-installation conference at jobsite. Initiate and conduct with supplier, installer and related trades. Coordinate materials and techniques and sequence complex hardware items and systems installation.
4. Key Conference shall be initiated and conducted with owner to determine system, keyway(s) and structure.

C. Installer Qualifications:

1. Installer to have not less than 3 years' experience specializing in installation of work in this section. Company must maintain qualified personnel trained and experienced in installing hardware.

## 1.3 REFERENCES

A. NFPA80 – Fire Doors and Windows

B. NFPA101 – Life Safety Code

C. NFPA105 – Smoke and Draft Control Door Assemblies

D. ANSI A117.1 Accessible and Usable Buildings and Facilities

## 1.4 SUBMITTALS

A. Hardware schedule: Submit digital copies of schedule. Organize vertically formatted schedule into Hardware Sets with index of doors and headings, indication complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size, quantity and finish of hardware items.
2. Name, part number and manufacture of each item.
3. Fastenings and other pertinent information.
4. Explanation of abbreviations, symbols and codes contained in schedule.
5. Door and frame sizes, materials and degrees of swing.

B. Product Data: Submit digital copies for each product indicated.

C. Templates: Obtain and distribute templates for doors, frames, and other works specified to be prepared for installing door hardware.

D. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

E. Keying Schedule: Prepared by or under the supervision of supplier, after receipt of the approved finish hardware schedule, detailing Owner's final keying instructions for locks.

F. Samples: Upon request submit material samples.

G. THE SPECIFICATION WRITER MUST APPROVE ALL SUBMITTALS BEFORE ORDERS CAN BE PLACED.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products to project site under provisions of Division 1 and as specified herein.

B. Tag each item or package separately, with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers: Thirty years mechanical, two years electrical
b. Exit Devices: Three years mechanical, one year electrical
c. Locksets: Ten years(ND), three years (everything else), one year electrical

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.

B. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation.

2.2 MANUFACTURERS

A. Approval of products from manufacturers indicated as “Acceptable Manufacturer” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

| ITEM | SCHEDULED MANUFACTURER | ACCEPTABLE MANUFACTURER |
|---|---|---|
| Hinges | Ives (IVE) | Hager, Bommer |
| Flush Bolts & Coordinators | Ives (IVE) | Burns, Rockwood |

| | | |
|---|---|---|
| Locksets & Deadlocks | Schlage (SCH) | No sub. |
| Aluminum Door Locks - Narrow Style | Adams Rite (ADA) | None |
| Exit Devices & Mullions | Von Duprin (VON) | No Sub. |
| Electric Strikes | Von Duprin (VON) | Trine, SDC |
| Power Supplies | Von Duprin (VON) | No Sub. |
| Cylinders & Keying | Schlage (SCH) | Everest 29 S keyway |
| Door Closers | LCN (LCN) | No sub |
| Automatic Operators | LCN (LCN) | Norton, Besam |
| Door Trim | Ives (IVE) | Trimco, Burns |
| Protection Plates | Ives (IVE) | Trimco, Burns |
| Overhead Stops | Glynn-Johnson (GLY) | Rixson, Sargent |
| Thresholds & Weatherstrip | Zero (ZER) | NGP, Reese, Pemko |

2.3 HANGING

A. Conventional Hinges: Hinge open width minimum, but of sufficient throw to permit maximum door swing. Steel or stainless steel pins:

1. Three hinges per leaf to 7 feet, 6-inch height. Add one for each additional 30 inches in height or any fraction thereof.
1. Provide 4 ½ x 4 ½ for 1 ¾" thick doors up to 3'5". Provide 5 x 4 ½ on doors 36" and over.
2. Exterior outswing doors to have non removable (NRP) pins.
3. Pin tips, flat button, finish to match leaves
4. Interior doors over 36" – Heavy weight
5. Interior doors up to 36" – Standard weight

2.4 LOCKSETS, LATCHSETS, DEADBOLTS

A. Heavy Duty Mortise Locks and Latches: Schlage L9000 Series

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security.
2. Provide lock case that is multi-function and field reversible for handing without opening case, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Provide electrified options as scheduled in the hardware sets.

6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: Schlage 06A

B. Extra Heavy Duty Cylindrical Locks and Latches: Schlage ND Series

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1.
2. UL listed for A label and lesser class single doors up to 4ft x 8ft.
3. Meets A117.1 Accessibility Codes.
4. Provide solid steel rotational stops to control excessive rotation of lever.
5. Provide completely refunctionable lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
6. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

    a. Lever Design: Schlage Sparta

C. Standalone Electronic Locksets: Schlage Electronics NDE series

D. Electronic Deadbolt BE467 series

1. Provide interconnected locksets with electronic deadbolt conforming to ANSI/BHMA A156.12, Grade 2 requirements, with simultaneous retraction of deadbolt and latch for single-operation egress, and certified by UL for 3-hour fire resistance rating.
2. Provide locks adjustable for 2-3/8 inches (60 mm) or 2-3/4 inches (70 mm) backset with 1/2 inch (13 mm) throw latchbolt and 1-inch throw deadbolt.
3. Door Thickness: Locksets adjustable to fit in 1-3/8 inches (35 mm) or 1-3/4 inches (44 mm) door thickness.
4. Strikes shall be standard 1-1/8-inches x 2-3/4-inches square corner strikes, unless extended-lip strikes are required for protection of trim.
5. Provide AA battery operated interconnected lockset, supporting smart credential technology.
6. Programming via mobile application through Bluetooth® connection.
7.

1. **NOTE:** Hardware supplier is asked to contact Michael Conn, Schlage Multi-Family Consultant, as to coordinate with the general contractor and access control provider to insure a non-proprietary card reader is used. This will insure the use of the Schlage dual tech fob, used on the unit entry locks, can work in both operating systems. If done so, the resident is not required to carry two fobs/credentials in accessing the building and resident unit entry.

E. ADD FOR TRAINING

F. USE ENGAGE SOFTWARE

1. Provide bored cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, non-handed, field-reversible.
2. Latchbolt Throw: 1/2-inch (13 mm) unless noted otherwise. Provide 3/4-inch (19 mm) throw for UL listing at pairs.
3. Chassis: Standard 161 cylindrical lock prep for 1-3/4-inch (44 mm) doors
4. Provide offline electronic access control products that comply with the following requirements:

    a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
    b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
    c. Compliant with ASTM E330 for door assemblies.

5. Provide functions as scheduled that are field configurable without taking the offline electronic product off the door.
6. Provide mechanical key override.
7. Power Supply: 4 AA batteries

    a. Provide electronic access control locks and/or exit device trim with the ability to communicate battery status.

8. Credential Reader:

    a. Proximity

9. Operation:

    a. Provide electronic access control locks and/or exit device trim with the ability to be configured at door by handheld programming device the length of time device is unlocked upon access grant.
    b. Provide electronic access control locks and/or exit device trim with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device.

10. Components:

    a. Schlage HHD series with Utility Software.
        1) Provide Handheld Programming Device for adaptable electronic access control products capable of the following minimum requirements.
            a) Capable of initializing lock and accessories using preloaded software.
            b) Utilized to field configure electronic access control devices, to download firmware updates and door files to device, and to download audit files from device.

G. Tubular Locksets: Schlage F Series

1. Provide tubular locks conforming to ANSI A156.2 Series 4000, Grade 2.

2. Provide locks with standard 2-3/8 inches (60 mm) adjustable to 2-3/4 inches (70 mm) backset with 1/2 inch (13 mm) latch throw. Provide 2 ¾ inches (70 mm) backset, unless 2-3/8 inches (60 mm) is required by door or frame detail, or noted otherwise.
3. Provide locksets that fit standard 2-1/8 inches (54 mm) diameter bore without use of thru-bolts.
4. Standard Rose Size: 2-1/2 inches (64 mm) in diameter.
5. Door Thickness: Locksets adjustable to fit in 1-3/8 inches (35 mm) or 1-3/4 inches (44 mm) door thickness.
6. Provide standard T-strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

    a. Lever Design: Schlage ELA

## 2.5 EXIT DEVICES

A. Panic and Fire Rated Exit Devices: Von Duprin 98/99 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, AND UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.

    a. Cable: Stainless steel core wire in stainless steel with polytetrafluoroethylene (Teflon®) liner color-coded to latches and center slides. Conduit and core wire ends snap into latch and center slides without use of tools.
    b. Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper- infiltrated steel, with molybdenum disulfide low friction coating.
    c. Top Latchbolt: Minimum 0.382 inch (10 mm) and greater than 90 degree engagement with strike to prevent door and frame separation under high static load.
    d. Bottom Latchbolt: Minimum of 0.44 inch (11 mm) engagement with strike.
    e. Product Cycle Life: 1,000,000 cycles.
    f. Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
    g. Latch release does not require separate trigger mechanism.
    h. Cable and latching system characteristics:
        1) Assembled prior to being installed in door.

2) Installed in door as complete assembly.
3) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
4) Connected to exit device at single attachment point.
5) Bottom latch height adjusted from single point, after system is installed and connected to exit device, while door is hanging
6) Latch position altered up and down 2 inches (51 mm) without additional adjustment.
7) System may be removed while door is hanging.
8) Configure latchbolt mounting: double or single tab mount for steel doors, and wood doors, face mount for aluminum doors, eliminating requirement of tabs.
9) Provide adjustable exit device to latch center line adjustment. Ensures double tab mounting option for top latch, regardless of exit device centerline.

6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.

## 2.6 ELECTRIC STRIKES

A. Manufacturers and Products: Von Duprin 6000 Series

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.7 KEYS, KEYING, AND KEY CONTROL

A. See Keying Requirements in this section

2.8 CLOSERS

1. interfering with closer mounting.

B. Surface Closers: LCN 4010/4110 Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

C. Surface Closers: LCN 1460 Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.9 OTHER HARDWARE

A. Door stops: Provide stops to protect walls, casework or other hardware.

1. Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
2. Where wall or floor stops are not appropriate, provide overhead holders.

B. Weatherstrip and Gasket

1. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled.
2. Provide non-corrosive fasteners as recommended by the manufacturer for application indicated.

C. Thresholds

1. Except as otherwise indicated, provide standard metal threshold unit of type, size and profile as detailed or scheduled.

D. Silencers

1. Interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

E. Kickplates

1. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

## 2.10 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups:

| | |
|---|---|
| Hinges | 630 Stainless Steel Exterior, 652 Dull Chrome Interior |
| Locksets | 626 Dull Chrome |
| Exit Devices | 626 Dull Chrome |
| Closers | 689 Aluminum |
| Kickplates | 630 Stainless Steel |

| | |
|---|---|
| Other Hardware | 626 Dull Chrome |
| Thresholds | Aluminum |
| Weatherstrip/Sweeps | Aluminum |

2.11 KEYING REQUIREMENTS

A. All keyed cylinders shall be subject to a new Schlage Masterkey system.

B. Furnish cylinders with construction cores. Following construction supply permanent keyed cores.

C. Cylinders to be furnished with visual key control with key code. Stamped on the face of the keys and marked on the back or side of the cylinders.

D. Key Quantities
   - 6 EA Master Keys
   - 4 EA Control Keys
   - 2 EA Construction Control Keys
   - 10 EA Construction Keys
   - 3 EA Change Keys per keyed alike group

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes. Notify Architect of any code conflicts before ordering materials.

3.2 INSTALLATION

A. Do not install surface mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

3.3 ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

B. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.

3.4 FOLLOW UP INSPECTION

A. Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit project with representative of the manufacturers of the locking devices and door closers to accomplish the following:

1. Re-adjust locks and closers
2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems and likely future problems.

3.5 DEMONSTRATION

A. Demonstrate electrical, electronic and pneumatic hardware system including adjustment and maintenance procedures

3.6 PROTECTION/CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

B.

DOOR HARDWARE GROUPS

Hardware Group No. 01

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | | 652 | IVE |
| 1 | EA | DEADBOLT | BE467F GRW 6 VDC | | 626 | SCH |
| 1 | EA | PASSAGE SET | ND10S RHO | | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 1461 | | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | | 630 | IVE |
| 1 | EA | DOOR STOP | 060 | | 652 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | | BK | ZER |
| 1 | EA | DOOR SWEEP | 39A | | A | ZER |
| 1 | EA | THRESHOLD | 545A-223 | | A | ZER |
| 1 | EA | VIEWER | U698 | | 626 | IVE |

Hardware Group No. 02

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 3 | EA | HINGE | 5PB1 3.5 X 3.5 | | 652 | IVE |
| 1 | EA | PASSAGE SET | F10 ELA | | 626 | SCH |
| 1 | EA | DOOR STOP | 060 | | 652 | IVE |
| 3 | EA | SILENCER | SR64/SR65 | | GRY | IVE |

Hardware Group No. 03

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 3 | EA | HINGE | 5PB1 3.5 X 3.5 | | 652 | IVE |
| 1 | EA | PRIVACY LOCK | F40 ELA | | 626 | SCH |
| 1 | EA | DOOR STOP | 060 | | 652 | IVE |
| 3 | EA | SILENCER | SR64/SR65 | | GRY | IVE |

Hardware Group No. 04

Provide each SL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 1 | EA | MULTIPLE BYPASS PACK | 111MD | | | JOH |
| 3 | EA | FLUSH PULL | 221 | | 626 | IVE |

Hardware Group No. 05

Provide each SL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 1 | | | HARDWARE BY DOOR / FRAME MANUFACTURER BY SLIDER SUPPLIER | | | |

Hardware Group No. 05XX - Not Used

Hardware Group No. 06

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | | 630 | IVE |
| 1 | EA | STOREROOM LOCK | ND80RD RHO | | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 S | | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 CUSH | | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | | 630 | IVE |
| 1 | EA | GASKETING | 50AA-S | | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | | A | ZER |
| 1 | EA | RAIN DRIP | 142A | | A | ZER |

Hardware Group No. ENGAGE

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | | FINISH | MFR |
|---|---|---|---|---|---|---|
| 1 | EA | MULTITECH READER | MT20W<br>ADD FOR SITE TRAINING | | BLK | SCE |
| 50 | EA | CREDENTIAL | 9651T<br>CONSTRUCTION | | BLK | SCE |
| 100 | EA | CREDENTIAL | 9691T | | BLK | SCE |

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes metal stud wall framing; metal channel ceiling framing; gypsum board and joint treatment; gypsum sheathing; cementitious backer board; and textured finish on existing and new gypsum surfaces.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 10 28 00 – Toilet and Bath Accessories.

1.2 REFERENCES

A. ASTM International:
1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
4. ASTM C630/C630M - Standard Specification for Water-Resistant Gypsum Backing Board.
5. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
6. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
7. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
8. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
9. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
10. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
11. ASTM C1396 / C1396M – Standard Specification for Gypsum Board.

12. ASTM D3272 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
15. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 - Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

C. Intertek Testing Services (Warnock Hersey Listed): WH - Certification Listings.

D. National Fire Protection Association: NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

E. Northwest Wall and Ceiling Bureau (NWCB): Wall and Ceiling Manual.

F. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

## 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal framing, gypsum board, joint materials, fasteners, surface texturing products.

C. Product Data: Submit physical characteristics and product limitations. Include test data from an independent testing agency to substantiate fire protection and acoustic performance required by the floor/ceiling assemblies in the drawings.

D. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

## 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840. ASTM C1280, GA-214, GA-216 and GA-600.

B. Fire Rated Wall, Floor and Roof Construction: Rating as indicated on Drawings. Tested Rating: Determined in accordance with ASTM E119.
1. Fire Rated Partitions, ceilings, column framing, beam framing, and shaft wall assemblies: Listed assembly by UL number and/or GA File number shown.

C. Surface Burning Characteristics:
1. Textile Wall Coverings: Comply with one of the following:
a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Listed Manufacturer: G-P Gypsum Corp and those specifically noted on drawings as proprietary**.**

B. Other Manufacturers accepted:
1. Celotex Building Products.
2. USG Corporation.
3. National Gypsum Co.
4. Substitutions: Section 01 25 13 – Product Substitution Procedures.

2.2 COMPONENTS

A. Framing Materials:
1. Studs and Tracks: ASTM C645; galvanized sheet steel; 16-, 18- and 20-gauge thickness, "C" shape, with knurled faces. Use deflection head tracks for all wall locations where top of wall is fastened to building structural members.
2. Furring, Framing, and Accessories: ASTM C645.
3. Fasteners: ASTM C514 and ASTM C1002.
4. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
5. Adhesive: ASTM C557.

B. Gypsum Board Materials:
1. Standard Gypsum Board: ASTM C1396/C1396M; 5/8 inch thick, or as thick as required for specific applicaiton; ends square cut, tapered edges.
2. Fire Rated Gypsum Board: ASTM C1396/C1396M; fire resistive type, UL or WH rated; 1/2 and 5/8 inch thick, maximum available length in place; ends square cut, tapered edges.
3. Moisture Resistant Interior Gypsum Board, wall and ceiling applications: ASTM C1396 / D3273; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges; moisture and mold resistant. USG Fiberock Brand Aqua-Tough Gypsum Interior Panels or approved equal, non-paper faced. **Required at all walls and ceiling in unit bathrooms.**
4. Exterior Gypsum Soffit Board: ASTM C1396/C1396M; fire or non-fire rated type as indicated on the drawings, 5/8 inch thick, maximum available length in place; ends square cut, tapered edges; non-paper faced.

5. Gypsum Backing Board: ASTM C1396/C1396M; fire and non-fire rated type as indicated on the drawings; 5/8 inch thick; tapered edges, ends square cut, maximum available size in place.
6. Cementitious Backing Board: ASTM C1325 High density, glass fiber reinforced, 1/2 inch thick; 2 inch wide, coated glass fiber tape for joints and corners.
7. For all types of gypsum board materials: minimum 10% recycled content post-consumer or 95% =post-industrial.

2.3 ACCESSORIES

A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

B. Trim Accessories: Provide manufacturer's standard hot-dipped galvanized ASTM C 840 steel beaded units with nailing flanges for concealment in joint compound.
1. Corner beads: Metal, or metal and paper combination.
2. L-type and J-type trim beads, for flush joint compound use.
3. Special shapes shown on the drawings and as needed to complete installation.

C. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.

D. Textured Finish Materials: ASTM C840 latex based texturing material, manufactured by National Gypsum Co., Gold Bond Building Products, U.S. Gypsum Company. **Level 4 finish required.**

E. Paint Primer: Refer to Section 09 90 00.

F. Fasteners: ASTM C1002, Type S12 for steel framing, W for wood framing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

C. Verify wood framing moisture content is 19% or lower.

3.2 INSTALLATION

A. Metal Stud Installation:
1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
2. Metal Stud Spacing: 16 or 24 inches on center as indicated on the drawings.
3. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

4. Door Opening Framing: Install double studs at doorframe jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
5. Blocking: Nail wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, wood frame openings, toilet accessories, hardware, and as otherwise indicated.

B. Wall Furring Installation:
1. Erect wall furring for direct attachment to concrete masonry units, concrete walls, or as otherwise indicated.
2. Erect furring channels horizontally or vertically as indicated; space maximum 16 oc, not more than 4 inches from floor and ceiling lines or abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
3. Erect metal stud framing tight to substrate materials, or spaced from substrate material as indicated on the drawings, attached by adjustable furring brackets.

C. Gypsum Board Installation:
1. Install gypsum board in accordance with GA-216 and GA-600.
2. Erect single layer board horizontal, with ends and edges occurring over firm bearing.
3. Erect single or double layer fire rated gypsum board as directed in the standards, with edges and ends occurring over firm bearing.
4. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
5. Use screws when fastening gypsum board to metal furring or framing.
6. Use nails or screws when fastening gypsum board to wood furring or framing. Staples may not be used.
7. Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions and ceilings. Secure second layer to first with fasteners. Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.
8. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
9. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
10. Place control joints consistent with lines of building spaces or as otherwise directed.
11. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials, or as indicated on Drawings.
12. Install cementitious backing board over studs, plywood sheet, or gypsum board as indicated on the drawings.
13. Apply gypsum board to curved walls in accordance with GA-216.

D. Joint Treatment:
1. Finish in accordance NWCB Level 4 finish.
2. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

3. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.
4. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile.
5. Fill and finish joints and corners of cementitious backing board.
6. Wet sanding of joints required to meet indoor air quality standards only if sanding is done out-of-sequence.

E. Texture Finish: Spray applied finish texture coating to all new, patched and existing surfaces to make consistent texture finish throughout occupied spaces. Apply to all existing or new walls and ceilings.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8” in 10 ft.

3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 09 65 00

# RESILIENT FLOORING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes resilient flooring sheet and plank products; resilient base; and accessories.

B. The Owner has established sustainability goals for this project. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

D. Related Sections:
   1. Section 09 68 16 – Sheet Carpeting.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   2. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
   3. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing.
   4. ASTM F1344 - Standard Specification for Rubber Floor Tile.
   5. ASTM F1861 - Standard Specification for Resilient Wall Base.

B. Federal Specification Unit:
   1. FS L-F-475 - Floor Covering Vinyl, Surface (Tile and Roll), with Backing.
   2. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant.

C. National Fire Protection Association: NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate seaming plan, custom patterns and inlay designs, only if indicated on the drawings or in this Section.

C. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions. Include standard line of product for Architect's selection/confirmation of colors.

D. Samples: Submit two sets of manufacturer's complete set of color samples for Architect's selection/confirmation of colors.

E. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

F. Provide SCS FloorScore certification compliance documentation.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics:
   1. Floor Finishes and Stair Coverings: Class I, minimum 0.45 watts/sq cm, or Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.
   2. Base Material: Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect roll materials from damage by storing in a method consistent with manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature in storage area between 55 degrees F and 90 degrees F, or as otherwise required by the manufacturer.

C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 VINYL SHEET FLOORING

A. Listed Manufacturer and Product: Mannington Commercial, Inc. "Jumpstart."

B. Other Manufacturers:
   1. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Performance Characteristics:
   1. Meets or exceeds ASTM F-1303.
   2. Wear Layer Thickness: 10 mils.
   3. Static Coefficient of Friction: Meets slip resistance of ADA requirements when tested according to ASTM D2047.
   4. Fire resistance: Smoke density 450 or less when tested in accordance with ASTM E662 and NFPA 258.
   5. Critical radiant flux: Class 1 according to ASTM E648 and NFPA 253.
   6. Roll width: 72 inches.
   7. Seam Sealer: MLG 33.
   8. FloorScore Certified.
   9. Twelve-year warranty.
   10. Pattern and Colors: Woods Towne Cherry Spice 71021.
   11. Locations: per finish schedule.

2.2 VINYL PLANK FLOORING

A. Listed Manufacturer and Product: Kentwood Floors, Evoke Luxury Vinyl - “Serena” Stick 3mm.

B. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Performance Characteristics:
   1. Wear Layer: 30 mil.
   2. Plank Size: 7” wide x 48” long x 1/8” thick.
   3. Finish: High performance polyurethane.
   4. Installation: Full spread adhesive.
   5. FloorScore Certified.
   6. Warranty: Manufacturer’s 20-year commercial.
   7. Pattern/Style: Bamboo.

2.3 UNDERLAYMENT

A. Listed Manufacturer and Product: Kentwood Pro Series ABM 2000 High Performance Underlayment.

B. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Performance Characteristics:
   1. Thickness: .070”.
   2. Roll Width: 72”.
   3. Fire resistance: Smoke density 450 or less when tested in accordance with ASTM E662.
   4. Radiant Flux: .045 m2 or greater Class 1 per ASTM E648.
   5. Installation: Full spread adhesive.
   6. FloorScore Certified.
   7. Warranty: Manufacturer’s 20-year commercial.

2.4 RESILIENT BASE

A. Listed Manufacturer: Roppe Corp.

B. Manufacturers:

1. Armstrong World Industries, Inc.
2. Azrock Commercial Flooring.
3. Mannington Commercial
4. Johnsonite.
5. Burke Industries Inc.
6. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Base: ASTM F1861 Rubber; top set coved, solid color throughout.
1. Height: 4-inch height as shown on the drawings and/or finish schedules.
2. Locations: as shown on drawings and/or finish schedules
3. Finish: Satin.
4. Length: Roll.
5. Accessories: Pre-molded external corners (miter internal corners).
6. Rubber reducer strips at all edges of resilient flooring.
7. Colors: Up to two (2), selected by the Architect/Owner from the full line.

## 2.5 ACCESSORIES

A. Subfloor Filler: Cementitious or premix latex, type recommended by adhesive material manufacturer and flooring manufacturer, Low-VOC.

B. Primers and Adhesives: Waterproof, Low-VOC, types recommended by flooring manufacturer.

C. Moldings and Edge Strips: Same material as flooring, unless otherwise indicated.

D. Sheet Flooring Vinyl Welding Rod: Solid vinyl bead produced by manufacturer of vinyl flooring for heat welding seams, in color matching field color.

E. Filler for Coved Base: manufacturer's standard.

F. Transition strip between carpet and resilient flooring sheet product, Roppe, or other listed manufactures. Color selected by architect.

G. Sealer and Wax: Types recommended by flooring manufacturer rated for high-traffic areas. (2) coats minimum installed. Confirm with Owner.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify concrete floors are dry to maximum moisture content as recommended by flooring manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

C. An adhesive bond test shall be performed and passed prior to beginning installations.

## 3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface. Note that some manufacturers require only Portland cement based patching and leveling materials be used for their products.

B. Prohibit traffic until filler is cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed. Apply primer to surfaces required by the manufacturer.

3.3 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

B. Double cut sheet; provide heat-welded seams.

C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure resilient strips by adhesive.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

F. Install flooring into the flange of floor drains. If flange-type drain is not installed, butt flooring to edge of drain and seal interface with same sealant used at other joints.

G. Install flooring in recessed floor access covers. Maintain floor pattern.

H. At movable partitions, install flooring under partitions without interrupting floor pattern.

I. Install feature strips and floor markings where indicated. Fit joints tightly.

J. **Install flooring to run continuously under kitchen and bathroom cabinets**.

3.4 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Install roll stock and maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to doorframes and other interruptions.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean, seal, and maintain resilient flooring products.

3.6 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

## 3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

# SECTION 09 68 16

# SHEET CARPETING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Work includes sheet carpet installed over pad, over substrate, and accessories in residential units indicated by the finish schedule

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. Project Specific Requirements:
   1. Carpet and pad must be CRI Green Label certified per the requirements of ESDS Criterion 7.2a.
   2. Carpet must not be installed at entry, kitchen or bathroom locations per the requirements of ESDS Criterion 7.2a.

D. Related Sections:
   1. Section 06 20 00 – Finish Carpentry.
   2. Section 09 65 00 – Resilient Flooring and Base.

### 1.2 REFERENCES

A. Carpet and Rug Institute: CRI – Carpet Installation Standard.

B. Certified Floor Covering Installers (CFI): CFI – Carpet Training and Certification.

C. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.

D. National Fire Protection Association:
   1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

E. NSF International (NSF)
   1. ANSI/NSF 140 – Sustainable Carpet Assessment Standard.

F. Underwriters Laboratory (UL):
   1. UL 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
   2. UL 723 – Test for Surface Burning Characteristics of Building Materials.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate seaming plan, method of joining seams, and direction of carpet pile.

C. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

1. Submit proof of CRI Green Label certification.

D. Samples: Submit two samples 12 x 12 inch in size illustrating color and pattern for each carpet color selected.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions and conditions requiring special attention.

F. MSDS Materials: Include material safety and data sheets for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

G. ESDS Binder: Include manufacturer's product information showing CRI Green Label Plus certification and VOC content of adhesives under Criterion 7.2a.

H. Closeout submittal
1. Section 01 70 00 - Execution & Closeout Requirements: Closeout procedures.
2. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics:
1. Floor Finishes: Comply with one of the following:
a. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
b. CPSC 16 CFR 1630.

B. Qualifications:
1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
2. Installer: Company specializing in performing work of this section with minimum three years experience.
a. CFI certified carpet installers.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Store materials in area of installation for 48 hours prior to installation.

C. Maintain minimum 70 degrees F ambient temperature for three days prior to, during and 24 hours after installation.

D. Ventilate installation area during installation and for three days after installation.

1.6 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Quantity: **None required**.

1.7 WARRANTY

A. Provide Owner with written manufacturer's warranty covering the following:
1. Warranty to be "non-prorate, full replacement warranty, including all labor".

2. Warranty to include:
   a. 10 years on surface wear.
   b. 10 years on backing delimitation.
   c. 10 years on seam construction.
3. Submit warranty that carpet will not display any significant change in color due to exposure to atmospheric contaminants.

## PART 2 PRODUCTS

### 2.1 CARPET

A. Listed Manufacturer: Shaw Contract Sentiment, 25 oz. solution-dyed polyester carpet.

B. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

A. Carpet Type
   1. Product Name and Style: Sentiment 60775
   2. Collection: Quiet Canvas.
   3. Description: 100% PureColor® solution dyed nylon.
   4. Color/Pattern: selected by Owner from manufacturer's standard line of colors.
   5. Locations: Unit bedrooms, or where identified on finish schedules.
   6. Warranty: Lifetime for stain and fade resistance; 15-year for soil resistance; 10-year for abrasive wear and manufacturing defects; 5-year for texture retention.

### 2.3 ACCESSORIES

A. Sub-Floor Filler: CementitiousType recommended by flooring material manufacturer.

B. Pad: 7/16" thick with density of 6 lb per cubic foot, as recommended Carpet and Rug Institute.

C. Moldings and Edge Strips: Rubber or vinyl, color selected by Architect.

D. Seam Adhesive: Recommended by manufacturer.

E. Contact Adhesive: Recommended by carpet manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination & project conditions.

B. Verify floor surfaces are smooth and flat within industry tolerances and are ready to receive work.

### 3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints,

holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. In general, strictly comply with manufacturer's printed installation instructions and in accordance with CRI 104.

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Lay out carpet and locate seams in accordance with CRI 104:
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within each contiguous area.

D. Install carpet tight and flat on subfloor, well fastened at edges, with uniform appearance.

E. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

F. Stretch-In Installation: Follow installation recommendations per CRI 104 for installing carpet under tension over a separate cushion, using tack-strips fastened at walls and other vertical abutments.

G. Trim carpet neatly at walls and around interruptions.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum carpet surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over unprotected floor surface.

C. Cover carpeting in traffic areas with protective non-staining building paper. Do not use plastic sheeting.

3.9 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. See section 01 50 05.

END OF SECTION

SECTION 09 90 00

# PAINTING AND COATING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings. Also included are shop applied transparent finishes for interior millwork, doors and frames.

B. The Owner has established sustainability goals for this project. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. It is a specific requirement of this Section that all interior paints and coatings meet the current Green Seal Standards requirements. Refer to Section 01 81 15 & 01 81 19.

C. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

D. Related Sections:
1. Section 05 50 00 - Metal Fabrications.
2. Section 06 20 00 - Finish Carpentry.
3. Section 08 16 00 – Molded Composite Doors.
4. Section 08 32 16 - Fiberglass Exterior Doors.
5. Section 09 21 16 - Gypsum Board Assemblies.
6. Section 32 17 00 - Pavement Markings / Storm Drain Labels.

E. Definitions:
1. Conform to ASTM D16 for interpretation of terms used in this section.

### 1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
1. ASHRAE Handbook of Fundamentals.

B. ASTM International:
1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D913 – Standard Practice for Evaluating Degree of Traffic Paint Line Wear.
3. ASTM D1729 – Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials.
4. ASTM D2369 - Standard Test Method for Volatile Content of Coatings.
5. ASTM D3450 – Standard Test Method for Washability Properties of Interior Architectural Coatings.
6. ASTM D3960 – Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

7. ASTM D4209 – Standard Practice for Determining Volatile and Nonvolatile Content of Cellulosics, Emulsions, Resin Solutions, Shellac, and Varnishes.
8. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
11. ASTM E2129 – Standard Practice for Data Collection for Sustainability Assessment of Building Products.

C. Federal Specifications (FS):
1. TT-P-1952 – Paint, Traffic and Airfield Marking, Waterborne.

D. National Fire Protection Association (NFPA):
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
2. NFPA 286: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
3. NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

E. PDCA Painting and Decorating Craftsman Manual and Textbook.

F. SSPC: The Society for Protective Coatings
1. MPI Architectural Painting Specification Manual

G. Underwriters Laboratories Inc. (UL):
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

H. Green Seal: GS-11 Green Seal Environmental Standard for Paints and Coatings.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on finishing products.

C. Samples:
1. Submit four painted samples (draw-downs) illustrating selected colors for each color and system selected. Submit on illustration board stock 8x10 inch size.
2. Submit two samples of wood door veneer with shop-applied transparent finish, 8x10 inch size, illustrating wood grain, stain color and sheen. Refer to Section 08 14 16 and 08 14 33.

D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention.

E. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51. All interior paints and primers are required to be Green Seal certified under the current Green Seal Standards.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics: Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Applicators: Company specializing in performing work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.9 SEQUENCING

A. Section 01 10 00 – Summary: Work sequence.

B. Sequence application to the following:
   1. Do not apply finish coats until paintable sealant is applied.
   2. Back prime wood trim before installation of trim.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Quantity: **None required**.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Listed Manufacturers: Interior Paint: Sherwin Williams.

B. Other Manufacturers:
1. Benjamin Moore.
2. Pratt & Lambert.
3. Rodda Paints.
4. The Glidden Co.
5. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Listed Manufacturers: Exterior Paint: Rodda.

D. Other Manufacturers:
1. Benjamin Moore.
2. Pratt & Lambert.
3. Sherwin Williams.
4. The Glidden Co.

E. Substitutions: Section 01 25 13 – Product Substitution Procedures

F. Listed Manufacturers: Traffic Coating (at balconies): ArmorThane STS-300, Rhino Linings TuffGrip.

2.2 COMPONENTS

A. Coatings: Ready mixed, except field-catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

B. Low VOC content: required for all interior applications. Refer to limits in Section 01 81 15, & 01 81 19.

C. Vapor-Retarder requirements for primer and topcoats, exterior wall assemblies: products shall be vapor semi-permeable, ASHRAE Class II, 1.0 perm or less and greater than 0.1 perm. (Do not provide if spray foam insulation is installed at exterior walls.)

D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

E. Patching Materials: Latex filler, Low-VOC (GS 11).

F. Fastener Head Cover Materials: Latex filler, Low-VOC (GS 11).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate conditions are ready to receive Work as instructed by product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent measured in accordance with ASTM F2659.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent measured in accordance with ASTM F2659.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors: 8 percent measured in accordance with ASTM F2659.

3.2 PREPARATION

A. Surface Appurtenances: Remove [or mask] electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

C. Marks: Seal with shellac those which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high-pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

I. Copper Surfaces Scheduled for Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

J. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

K. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

L. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.

Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

M. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

N. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

O. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

P. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

Q. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

R. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.

S. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

T. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with tinted primer.

U. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

## 3.3 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

C. Sand wood and metal surfaces lightly between coats to achieve required finish.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

F. Prime concealed surfaces (back-prime) of interior and exterior woodwork with primer paint.

G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

H. Finishing Mechanical And Electrical Equipment (exposed to view in the finished work):
   1. Paint shop primed equipment.
   2. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   3. Prime and paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, with the exception of shop finished items or specifically noted to be left unpainted.
   4. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.
   5. Paint exposed conduit and electrical equipment occurring in finished areas.
   6. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and/or numbering.
   7. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

I. Do not apply finishes to the following materials:
   1. Metals as listed: brass, bronze, copper, plated metals, stainless steel, anodized aluminum.
   2. Acrylic wall coverings.
   3. Materials having a complete factory finish including: electrical switch plates, lighting fixtures, and finish hardware.
   4. Finished cabinets.
   5. Pre-finished wood.

J. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

## 3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Collect waste material that may constitute fire hazard, place in closed metal containers, and remove daily from site.

## 3.5 SCHEDULE – SHOP FINISHED ITEMS

A. See 05 50 00 - Metal Fabrications and 05 52 00 - Metal Railings for shop finishes associated with exterior metal stairs.

## 3.6 SCHEDULE – **EXTERIOR SURFACES**

A. General Prep:
   1. Caulk all splits and cracks. Press all caulking into gaps using a finger or appropriate tool. Use the specified patching compound for gaps exceeding 1⁄4 inch. Refer to manufacturer’s printed instructions for further instructions regarding caulking or patching compounds. Caulking shall be carefully completed and, if necessary, trimmed and smoothed to provide a uniform surface.
   2. Caulking: Sashco Big Stretch Caulk.

B. Priming:
   1. All unprimed areas (except metal): Rodda 501601x First Coat Primer.
   2. All rust and unprimed metal with: Rodda 70822x Barrier III High Solids Metal Primer.
   3. No primer over wood fencing.

C. Fiber Cement Panel / Lap Siding and Trim:
   1. Rodda 521101x AC909 Satin
   2. Follow fiber cement siding manufacturer's printed painting instructions.
   3. Apply by sprayer, brush and roll, 1 coat to all surfaces to be painted, minimum dry film thickness of 1.5 mils (4 mils wet).

D. Door and Wraps:
   1. Rodda 542001x Unique II Semi-Gloss..
   2. Apply 2 coats. Additional coats may be required, minimum dry film thickness of 1.5 per coat, 4 mils wet per coat

E. Wood Fencing:
   1. Cloverdale 06680 WeatherOne Semi-Transparent 100% Acrylic Stain
   2. Apply 1 coats to cover, spray & back roll using.

3.7 SCHEDULE – **INTERIOR SURFACES**

A. Fiberglas Entry Door and Millwork:
   1. One coat: Sherwin Williams B51W00620 PrepRite ProBlock Int/Ext Latex Primer/Sealer MPI#6
   2. Two coats: Sherwin Williams A76W00051 SOLO Int/Ext 100% Acrylic, Semi-Gloss MPI#54.

B. Wood Door and Trim
   1. One coat: Sherwin Williams B51W00620 PrepRite ProBlock Int/Ext Latex Primer/Sealer MPI#6.
   2. Two coats: Sherwin Williams A76W00051 SOLO Int/Ext 100% Acrylic, Semi-Gloss MPI#54.

C. Gypsum Board Walls and Ceilings:
   1. One Coat: Sherwin Williams B51W08670-Quick Dry Int/Ext Stain Blocking Primer MPI#149.
   2. One Coat: Sherwin Williams B20W03050-Property Solutions Int Latex Eggshell.
   3. Walls and Ceilings: Coats to cover, spray and backroll in all units and laundry rooms.

D. Bathrooms and Kitchens:
   1. One Coat: Sherwin Williams B31W3060-Property Solutions Int Latex Semi-Gloss.
   2. Additional mildew control additive - Trimaco Mildew Control (Solar Chemicals)

3.8 SCHEDULE - COLORS

A. For exteriors, allow up to **three (3)** building color schemes. For each building color scheme, allow **three (3)** total primary paint colors **(9 colors total).** Each building color scheme will use **one (1)** total color for exterior trim.

B. For interiors, allow up to **two (2)** primary paint colors and up to **two (2)** accent paint colors per building. Verify through submittal process; colors selected by Architect/Owner.

3.9 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

END OF SECTION

# SECTION 10 14 00

# SIGNAGE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes installing Owner-provided contractor-installed exterior and interior non-illuminated signs and contractor-provided and installed site signage.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

### 1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Info: Product information for method of attachment for interior signs.

C. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components.

### 1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package signs, labeled in name groups.

C. Store adhesive products at ambient room temperatures.

### 1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install signs when ambient temperature is lower than recommended by manufacturer.

C. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 EXTERIOR AND INTERIOR SIGNS

1. Owner provided. Contractor installed.

2.2 MATERIALS – SITE SIGNS – Contractor supplied and installed.

A. **Sign Type A**: Accessible parking signs: located in walks at designated vehicle stalls.

B. Mounting Locations: Refer to drawings for mounting requirements. Where location is not specifically identified on drawings, contact Architect for direction. Review location of all signs prior to installation with Architect.

2.3 MATERIALS – EXTERIOR SIGNS – Owner supplied. Contractor installed.

A. **Sign Type B:** Typical exterior building & address identification placards: Raised characters on acrylic face. Mounting on 1/4" projected spacers. Two signs for each building at locations. Verify locations with Owner/Architect.
   1. *Example*: A 3015
   2. See G001 for building number and address

B. **Sign Type C:** Typical exterior building & address identification placards: Raised characters on acrylic face. Mounting on 1/4" projected spacers. One sign for each building/stair entry. Verify locations with Owner/Architect.
   1. *Example*: UNITS 17 – 20,
   2. See A101-A103 for unit numbers

C. **Sign Type D:** Typical exterior building & address identification placards: Raised characters on acrylic face. Mounting on 1/4" projected spacers. One sign for each building entry. Verify locations with Owner/Architect.
   1. ELECTRICAL ROOM
   2. WATER ROOM

2.4 MATERIALS – INTERIOR SIGNS - Owner supplied. Contractor installed.

A. **Sign Type E:** Typical apartment unit numbers: Provide Gatehouse 3.86” satin nickel unit numbers at entry door to each unit. Adhesive mounting. Number scheme per building as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 INSTALLATION

A. Install signs after doors are installed and wall surfaces are finished, in locations directed.

B. Secure all items with tamperproof fasteners recommend by manufacturer and as specified.

C. Set level, plumb, and at the height indicated. Mounting surface shall be free from distortion or other defects in appearance.

D. If installation is on glass relites, install with double-backed foam tape on interior glass relite surfaces with a matching base plate for the reverse of the glass to hide tape.

3.3 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 10 28 00

# TOILET AND BATH ACCESSORIES

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes toilet room accessories; shower and tub accessories; and utility room accessories.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 07 90 00 – Joint Protection.
3. Section 09 21 16 – Gypsum Board Assemblies.
4. Section 09 90 00 – Painting and Coating.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
7. ASTM C1036 - Standard Specification for Flat Glass.

B. Federal Specification Unit: FS A-A-3002 - Mirrors, Glass.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Submit special procedures, conditions requiring special attention.

D. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coat Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51, if applicable.

E. Provide manufacturer’s certification that grab bars and mounting hardware satisfy ANSI A117.1 (2009) loading requirements (250 lbs.).

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with placement of internal wall reinforcement and reinforcement to receive anchor attachments.

PART 2 PRODUCTS

2.1 TOILET AND BATH ACCESSORIES

A. Listed Manufacturers:
1. Bobrick: for **Unit** grab bars.
2. Franklin Brass: for **Unit** towel bars and toilet paper holders.
3. Glacier Bay: for **Unit** shower rods & medicine cabinets.
4. Mustee: for **Unit** shower seats.
5. Section 01 25 13 – Product Substitution Procedures.

2.2 COMPONENTS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation. Grind welded joints smooth. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Adhesive: Silicone, waterproof.

C. Fasteners, Screws, and Bolts: Stainless steel, tamper-proof.

D. Finish: as noted below, all items factory finished ready for field installation.

E. Refer to accessory schedule for specific room accessories. Refer to drawings for locations.

2.3 TYPICAL UNIT BATHROOM ACCESSORIES

A. Toilet Paper Holder: Franklin Brass Futura D2408PC - surface mounted, die-cast zinc with polished chrome finish; spindle chrome-plated plastic.

B. Towel Bar: Franklin Brass Futura D2424PC - surface mounted, 24-inch die-cast zinc with polished chrome finish; locations and quantities as shown on the

drawings. Advise Architect/Owner if selected size will not work in location identified.

C. Robe Hook: Franklin Brass Futura D2402PC – surface-mounted multi-purpose hook, die-cast zinc with polished chrome. 1per bathroom.

D. Shower curtain rod: (Glacier Bay) adjustable 72” length carbon steel larger end caps, tension shower rod in white.

E. Medicine Cabinet: (Glacier Bay T30-WH-B) 30”x30” surface-mount tri-view mirrored medicine cabinet, white finish.

F. Grab Bars: (Bobrick B-6806 Series) stainless steel, 1-1/2 inches outside diameter, nonslip grasping surface finish, snap-flange mounting; 1-1.2 inches clearance between wall and inside of grab bar. Length and configuration as indicated on drawings.

G. Fold-Down Seat: (Mustee 390.409) Wall-mount, rectangular fold-down seat – 26” long, white.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify exact location of accessories for installation.

C. Verify field measurements are as indicated on product data.

D. Verify that blocking has been installed in walls behind accessories.

### 3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights and Locations: As indicated on Drawings. If location is not indicated, notify Architect for direction.

C. Provide solid blocking behind bathroom accessories as notes on drawings.

### 3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 10 60 00

# INTERIOR AND EXTERIOR SPECIALTIES

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes supplying and installing miscellaneous interior and exterior specialties including mailbox enclosures, closet shelving, acrylic tub surrounds in apartment bathrooms, and deck coating for top landing of exterior entry stairs.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 10 00 – Rough Carpentry.
2. Section 09 21 16 – Gypsum Board Assemblies.
3. Section 09 90 00 – Painting and Coatings.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
7. ASTM C1036 - Standard Specification for Flat Glass.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on specialty products describing size, finish, details of function, attachment methods.

C. Samples: Submit four samples of each specialty product where Architect is required to make a finish selection, illustrating color and finish choices.

D. Manufacturer's Installation Instructions: Submit special procedures, and conditions requiring special attention.

E. VOC Limits: Include manufacturer's literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

F. Submit certification from manufacturer stating the percentage of recycled content material, identifying post-consumer and post-industrial contents.

G. Provide manufacturer's literature certifying that steel products contain a minimum of 18% recycled scrap content. Identify post-consumer and post-industrial percentages.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with placement of internal wall reinforcement.

PART 2 PRODUCTS

2.1 INTERIOR SPECIALTIES, MANUFACTURERS AND MODEL NUMBERS

A. **Closet shelving**: Locations and number shown on drawings. Coated steel ventilated wire closed mesh shelving. Install with wall brackets, end caps, hold-down clips and other accessories standard with the manufacturer for a complete installation. Provide solid blocking behind
   1. Listed Manufacturer: Closetmaid and/or substitutions: Section 01 25 13 – Product Substitution Procedures.
   2. Bedroom closets: nominal 12" deep with coat hanger rod under shelf.
   3. Entry and hallway closets: nominal 16" deep. ClosetMaid or approved equal. Shelving in bedroom closets in unit D shall be adjustable to 42"-60" above finished floor.

B. **Tub surrounds**: Mustee Durawall 350WHT fiberglass wall system. Compression-molded non-porous material with a durable baked-on industrial coating and very high shine that will not mold or mildew. Limited 5-year warranty for commercial applications. Do not install before installation of solid backing/blocking at future grab bar locations.

2.2 EXTERIOR SPECIALTIES, MANUFACTURERS AND MODEL NUMBERS

A. Manufacturer and/or product model substitutions: Section 01 25 13 – Product Substitution Procedures.

B. **Exterior Deck Coating:** Spray applied polyurethane or polyuria deck coating, applied at top landing of all exterior entry stairs. ArmorThane STS-300, Rhino Linings TuffGrip, or approved equal. Install in strict accordance with manufacturer's

written installation instructions. Provide all required accessories for warrantable installation.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify exact location of products for installation.

C. Verify field measurements are as indicated on product data submittal.

### 3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Follow manufacturer's printed instructions, using manufacturer's standard attachment devices and procedures.

C. For wall corner guards: position guard above wall base and extend to a point 36" above the finished floor for painted walls, or to the top of the wall covering for walls with a specified wall covering finish.

D. Adjust all moving parts to operate smoothly.

E. Leave product and adjacent area clean and free of defects.

### 3.4 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

# SECTION 11 31 00

# APPLIANCES

## PART 1 GENERAL

### 1.1 SUMMARY

A. Work includes but is not limited to residential kitchen as shown on drawings, including Owner-provided Contractor-installed appliances.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 12 35 30 – Casework.
3. Division 26 – Electrical.

### 1.2 SUBMITTALS

A. Section 10 33 00 - Submittal Procedures: Submittal procedures.

B. Setting drawings: Provide setting drawings showing all installation conditions for built-in equipment.

C. Product data: Submit copies of manufacturer’s product data, installation, and maintenance instructions for each appliance. Transmit extra copies of installation instructions to installer.

D. Provide templates, instructions, and directions required to insure accurate location of utility rough-in and anchorage devices.

E. Operation and Maintenance Data per Section 01 70 00: Submit in triplicate manufacturer’s printed directions.

### 1.3 QUALITY ASSURANCE

A. Section 01 41 00 - Regulatory Requirements: See referenced codes, ordinances, and the like.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Carefully crate and insulate against marring, and other damage in transit.

C. Acceptance at site: Carefully uncrate. Verify units in satisfactory condition.

D. Store out of harm’s way. Handle units carefully, prevent marring. Protect units at all times.

### 1.5 SERVICE AND WARRANTY

A. Fully guarantee each unit against defects in function and appearance (not

caused by abuse) for a period of two years minimum (or longer if standard with manufacturer) from date of Substantial Completion.

B. Remove, reinstall new units, transport, furnish parts, labor and any other service or material necessary to correct defective units. All appliances are to be in perfect operating condition.

C. Supplier to be in position to offer service contract after warranty expiration.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Listed Manufacturer: GE, unless otherwise noted.

B. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Provide all product types from the same Manufacturer for consistency and uniformity.

D. Submittal package shall indicate manufacturer's current model number if different than the model listed.

E. Color: white unless otherwise indicated.

### 2.2 DWELLING UNIT AND OFFICE KITCHEN APPLIANCES

A. Owner-Provided and Contractor-Installed:
   1. ADA Oven/Range: GE # JBS45DFWW – **Unit D**
      a. 30" wide free-standing electric range.
      b. ADA compliant.
   2. Oven/Range: GE # JB256DMWW - **Units**
      a. 30" wide free-standing electric range.
   3. Refrigerator/Freezer: GE # GTE16DTHWW - **Units**
      a. Top-freezer refrigerator, white finish, 15.5 cu.ft.
      b. Energy Star labeled.
      c. ADA compliant.

B. Contractor Provided and Installed:
   1. Range hood: Air King ESDQ1308 - **Units**
      1. 30" wide, white finish, LED lamp.
      2. Energy Star labeled.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect work of all other trades and verify conditions as complete and satisfactory for appliance installation.

B. Verify that equipment may be installed in accordance with original design and manufacturer's recommendations.

C. Discrepancies: In the event of discrepancy, immediately notify Architect. Do not proceed until all discrepancies have been fully resolved.

3.2 INSTALLATION, POSITION

A. Install in accordance with all referenced regulation requirements and manufacturer's directions.

B. Deliver self-supporting units to room.

C. Set in location indicated, level, and properly align with casework and other fixtures.

D. Secure as necessary.

E. Check operation. Appliances are to be in perfect operating condition. Remove all packing, paper wrapping, etc. prior to operating each appliance.

F. Arrange for and coordinate electrical and mechanical connections as applicable.

G. Arrange for and coordinate electrical and mechanical connection as applicable. Ranges shall sit flush against back walls – coordinate with Division 26 work & the installation of timer related equipment to assure that flush installation is achieved.

3.3 FIELD QUALITY CONTROL

A. Conduct inspection and tests of equipment in presence of Architect.

B. Remove, transport, reinstall, furnish parts, labor and any other service or material necessary to replace defective units.

3.4 ADJUSTMENTS AND CLEANING

A. Adjust unit as required for proper operation.

B. Leave installations clean; premises free from residue of work of this section.

3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

3.6 PROTECTION OF INSTALLED WORK

A. Protect installed units against damage and deterioration during remainder of construction period.

END OF SECTION

# SECTION 12 20 00

# WINDOW TREATMENTS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Work includes but is not limited to vertical blinds as shown on drawings or scheduled herein including all required miscellaneous parts and accessory items for complete installations.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
   1. Section 08 53 00 – Plastic (PVC) Windows.
   2. Sections 09 21 16 – Gypsum Board Assemblies.

### 1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop drawings: Provide shop drawings showing all installation details, dimensions, fastenings and accessories.

C. Product data: Submit copies of manufacturer’s product data, performance data, installation, and maintenance instructions. Provide color chart or samples as required for Architect's selection/confirmation of colors.

D. Operation and Maintenance Data per Section 01 70 00: Submit in triplicate manufacturer’s printed directions.

E. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

### 1.3 QUALITY ASSURANCE

A. Section 01 40 00 Quality Requirements. Installer to be "specialist" as defined therein, and acceptable to product manufacturer.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Deliver in protective wrappings.

C. Acceptance at site: Carefully unwrap. Verify units in satisfactory condition.

D. Store out of harm's way. Handle units carefully, prevent marring. Protect units at all times.

## PART 2 PRODUCTS

### 2.1 VERTICAL BLINDS

A. Listed Manufacturer: Levelor.

B. Other Manufacturers:
1. Graber.
2. Substitutions: Section 01 25 13 – Product Substitution Procedures.

C. Style: Trim+Go, Vertical Blinds.

D. Louver: Vinyl S-Curved

E. Operation: Cordless; wand-operated.

F. Headrail formed of steel or extruded aluminum. Operating mechanisms fully enclosed.

G. Color: Selected by Architect/Owner from manufacturer's full color line. All blinds shall be of one color.

H. Sizes shall be as recommended by manufacturer for condition of installation, and based on field-measured openings. Size so that louvers rests 1/2" above windowsill and 1/2" clear of window liners. Field measure to confirm opening size prior to fabricating blinds.

I. Locations: at all exterior windows and sliding doors with lites within residential apartments. All windows and sliding at Office.

J. Fasteners, shims and the like as standard with the manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect work of all other trades and verify conditions as complete and satisfactory for appliance installation.

B. Field verify window dimensions prior to fabrication.

C. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

D. Discrepancies: In the event of discrepancy, immediately notify Architect. Do not proceed until all discrepancies have been fully resolved.

### 3.2 INSTALLATION, POSITION

A. Install in accordance with manufacturer's written instructions and approved shop drawings.

C. Set window treatments at locations indicated; install level, and properly aligned to operate freely.

D. Position window treatments level, plumb, and at proper height relative to adjacent construction. Secure with brackets and fasteners recommended by manufacturer.

3.3 ADJUSTMENTS AND CLEANING

A. Check operation. Operate shade through complete cycle of lowering, stopping, and raising to ensure proper operation. Correct deficiencies and adjust for smooth operation.

B. Leave installations clean, and premises free from residue of work of this section.

3.4 PROTECTION OF INSTALLED WORK

A. Clean window treatment assemblies and protect from damage from construction operations. If damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

3.5 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

END OF SECTION

SECTION 12 35 30

CASEWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes modular cabinets and cabinet hardware in apartment kitchens.

B. The Owner has established sustainability goals for this project, and this Section contains specific information and requirements for compliance. Refer to Section 01 81 15 for specific requirements.

C. It is a specific requirement of this Section that non-toxic and low-VOC products be used for this project, and that all interior paints, coatings, adhesives and sealants meet specified requirements. Refer to Section 01 81 15 & 01 81 19.

D. Design and performance criteria for this Section regarding health, safety and durability shall take precedence over sustainable design criteria. The Contractor shall inform the Owner and Architect of any conflicts that may result between the noted recycled content and the strength of the materials.

E. Related Sections:
1. Section 06 61 16 – Quartz Countertops.
2. Section09 68 16 – Resilient Flooring.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A156.9 - Cabinet Hardware.
2. ANSI A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets.

B. Kitchen Cabinet Manufacturers Association: KCMA - Directory of Certified Cabinet Manufacturers.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate casework locations, scale plans, elevations, rough-in and anchor placement dimensions and tolerances, and clearances required. Provide plan and elevation drawings based on as-built room dimensions and indicate any filler panel location and sizes required.

C. Product Data: Submit component dimensions, configurations, construction details, joint details, and standard hardware.

D. Samples: Submit fully finished sample, including face frame, door and drawer fronts and hardware, including stain color finish options.

E. Urea Formaldehyde: Include manufacturer’s literature stating that no cabinetry components contain added urea formaldehyde.

F. VOC Limits: Include manufacturer’s literature for each adhesive, coating and sealant used in this Section identifying VOC limits and chemical components. All adhesives must conform to the South Coast Air Quality Management District

Rule 1168 and all sealants must conform to Bay Area Air Quality Management District – Regulation 8, Rule 51.

G. Submit certification from manufacturer verifying the location of the manufacturer, including full address and phone number, and list of materials harvested, extracted or recovered within 500 miles of the project site.

H. Provide certification from manufacturer verifying the location of the fabricator for products of this Section. Include mailing address and phone number. Provide list of recovered or recycled steel within 500 miles of project site.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A161.1 and KCMA certification.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.6 WARRANTY

A. Provide manufacturer's 5-year warranty on cabinets and limited lifetime warranty on drawer box, drawer guides and hinges.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Specifications are based on Aristokraft Cabinetry, Jasper, IN for all residential area cabinets. Other manufacturer's offering products meeting requirements are:
   1. Canyon Creek, Monroe, WA.
   2. Substitutions: Section 01 25 13– Product Requirements

2.2 MATERIALS AND CONSTRUCTION FOR WOOD CABINETS

A. All materials/products to have no added urea formaldehyde (NAUF).

B. Finished Surfaces: All exposed ends and sides shall have matching material and finish. Cabinets with adjacent removable cabinets or self-supporting appliances shall have an adjacent finished side to allow for removal. Finished exteriors are factory hand-wiped stain, spray lacquer seal coat and catalyzed lacquer finish coat.

C. Cabinet Box: Sides, tops and bottoms from 3/8" and 1/2" plywood with birch veneer interior finish with natural UV finish and hardwood veneer exposed exterior.

D. Wood species and finish: Birch, Autumn finish.

E. Refer to cabinet elevations on drawings.

F. Shelves: 3/4" thick white laminate. Adjustable by the use of metal pegged shelf clips with holes at 2" o.c. Provide 200 extra clips for Owner's stock.

G. Drawer Guides: 7/8 extension, 100 lb. load capacity. Epoxy coated white finish; one-sided captive guide rail; integrated self-closing feature, double STOP and rollout prevention; noise absorbing plastic rollers, brushed bearings.

H. Cabinet Doors and Drawer Fronts: Solid slab drawer fronts, 3/4” solid door rail and flat veneer center panel.

I. Door Style: *Benton*, Shaker style.

J. Drawer Box: Screwed to drawer front. Sides, front and back from 3/4” birch wood, dovetail joint. Bottom from 1/4” plywood.

K. Box, shelf and drawer construction to meet referenced standards.

L. Hinges: Self-closing, fully adjustable, concealed hinges; opening angle 110º.

M. Pulls: Provide Liberty 1-1/4” satin nickel, round solid knobs on doors and drawers. Typical in units.

N. Door Bumpers: Resilient plastic with adhesive back; clear color; 5/16” diameter x 3/64”.

O. Cabinet construction to be a minimum 25% recycled content post-consumer.

## 2.3 COUNTERTOPS

Refer to Section 06 61 16.

## 2.4 APPLIANCES

Appliances are supplied under Section 11 31 00. Coordinate cabinet design and installation to accommodate size and location of appliances shown.

## 2.5 LOCATIONS

See architectural interior elevations.

## 2.6 FABRICATION

P. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

Q. Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

R. Fabricate each unit rigid, not dependent on building structure adjacent units for rigidity.

S. Form edges smooth. Form material for counter tops from continuous sheets.

T. Provide cutouts for plumbing fixtures and appliances. Prime paint contact surfaces of cut edges.

U. When necessary to cut and fit on site, furnish materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

V. Exposed To View Surfaces and colors: selected by the Architect from the manufacturer's standard finish choices.

W. Interior Surfaces: manufacturer's standard vinyl/melamine surfacing.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of support framing.

### 3.2 INSTALLATION

A. Install casework, components and accessories.

B. Use anchoring devices to suit conditions and substrate materials encountered.

C. Set casework items plumb and square, securely anchored to building structure.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Use filler strips; not additional overlay trim for this purpose.

E. Close ends of units, back splashes, shelves and bases. Joints between units to be tight and flush.

F. Sealants: Refer to Section 07 90 00 for type. Apply continuous bead of clear sealant at top of countertop splash-to-wall.

### 3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

### 3.5 CABINET INSTALLATION

A. Install cabinets to be true, level and plumb. Install in complete compliance with manufacturer’s printed instructions.

B. Fasten adjacent cabinets with manufacturer’s installation screws through face frame edges (pre-drill). Joints between cabinets to be tight and flush.

C. Fit tight to walls and anchor to wall studs or solid blocking as prescribed by the manufacturer from interior of unit.

D. Closure strips to be scribed accurately to wall surface -- any gaps to be filled with sealant -- specified in Section 07 90 00.

E. Adjust all hardware to proper function and fit.

### 3.6 COUNTERTOP INSTALLATION

A. Attach countertops securely to base cabinets with continuous bead of construction adhesive applied to cabinet top frame stiffeners. Apply hand pressure or clamp to seat and screw from underside through cabinet frame into top.

B. Where joining more than one section or where mitering sections, apply carpenter’s glue to both edges and draw panels together using 3 or more 3” minimum x 1/4” countertop drawbolts. Drawbolts are to be recessed into routed slot in underside of countertop.

C. Factory-made tops shall be mitered and joined accurately. Any minor gapping shall be filled with a matching seam filler

D. Provide cutouts for fixtures and appliances as indicated - seal penetrations (cut edges).

E. Install sealant at top of splash to wall. Sealant specified in Section 07 90 00.

3.7 WASTE MANAGEMENT

A. Separate waste in accordance with the Waste Management Plan. Set aside extra materials for reuse by Owner. Materials not required by the Owner should be donated to non-profit organizations (such as Habitat for Humanity or other similar programs) where feasible.

B. Where possible, give preference to suppliers who take back waste for re-use or recycling.

C. Determine local options for recycling, collect all remaining unused materials by type and transport to a legitimate recycling facility.

D. Close and tightly seal all partly used adhesive or sealant containers, and store protected in well-ventilated, fire-safe area at moderate temperature.

E. Place used sealant tubes and near empty containers in areas designated for hazardous materials.

F. Collect cut-offs and scraps and place in designated area for recycling.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean casework, counters, shelves, and hardware.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 21 00 00

# FIRE SUPPRESSION GENERAL CONDITIONS

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 1 - General Requirements for all work.

### 1.2 SUMMARY

A. Design Intent:
1. System to provide coverage for entire building.
2. Provide hydraulically designed (or pipe schedule only if acceptable by authorities having jurisdiction) system to NFPA 13R occupancy requirements.
3. Determine volume and pressure of incoming water supply from water flow test data.
4. Interface system with building fire and smoke alarm systems.
5. Piping from the site connection to the flange at the base of the sprinkler riser is specifically included in Division 21 00 00.

B. **This is a design/build specification.** Provide all required design, permits, labor, materials and installation of fire protection work, complete and operable in accordance with these specifications and drawings. Work of Division 21 includes, but is not limited to, that as delineated in conceptual information shown on the drawings and the following specification sections:

21 00 00 Fire Suppression General Conditions

21 05 00 Common Work Results for Fire Suppression

21 13 13 Wet-Pipe Sprinkler Systems

### 1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over fire protection installation.
1. International Building Code (IBC) with local amendments.
2. National Electrical Code (NEC) NFPA 70.
3. Requirements of OSHA.
4. National Fire Protection Association (NFPA) Codes and Standards.
5. ASTM, ASME, ANSI and NEMA standards, as referenced in subsequent sections.
6. Local Water District Requirements.
7. Local Health Department Requirements.

1.4 SUBMITTALS

A. See Division 01 - Submittal Procedures.

B. Field Test Reports: Include results of hydrostatic and flow tests with hydraulic calculations.

C. Design Data: Submit design calculations signed and sealed by NICET Level III Certified Designer.

D. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 21 and all additional products noted on drawings or required for completion of project.

E. Electronic: **All sections of Division 21 shall be submitted together in one complete PDF file with bookmarks for each section. Multi-part submittals will be returned without review.**
1. First Page: Name of Project, Owner, Location & Contracting Company.
2. Index Page: List of specification sections with contents by Tag or item.
3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

F. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate model and all accessories intended for use.

G. Equipment vendor cover page with contact information shall precede submittal by that vendor.

H. Submitted product information shall include (as applicable) but not be limited to the following information:
1. Product description
2. Manufacturer and model
3. Dimensions
4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
5. Construction Materials
6. Ratings (i.e. UL, FM, NEMA, etc)
7. Electrical data
8. Vibration Isolation
9. Controls and wiring diagrams
10. Accessories
11. Engineering technical data (i.e. pressure drops, leakage rates, pump curves)

1.5 SHOP DRAWINGS

A. Prepare Shop Drawings stamped and signed by a NICET Class III Certified designer. Develop in accordance with NFPA 13R and the State and Local Fire Marshals. Submit PDF copies of these drawings for approval prior to beginning work.

B. Submit shop drawings to Architect, Local Fire Marshal, and all other approving authorities. Drawings shall be approved by all agencies prior to fabrication or installation. **Drawings submitted for Architect's approval shall have been stamped approved by the Fire Department.**

C. The Contractor shall draw the design team's attention to any areas in which they contemplate deviations from the conceptual information shown on the contract documents (e.g., due to site conditions).

D. These drawings and diagrams shall show all pipe sizes as well as the manufacturer's name and catalog number of each piece of equipment used.

E. The Architect's review of such drawings shall not relieve the Contractor of responsibility for deviations from the Contract drawings or specifications, nor shall it relieve him from responsibility for errors or omission in such drawings.

F. Fire Sprinkler shop drawings shall indicate all relevant pipe, ceiling, and structural elevations and clearances. All elbows, offsets, and turns shall be clearly identified. All required access doors shall be shown. By submission of sheet fire sprinkler shop drawings, the Contractor acknowledges that coordination has been done to ensure that all ductwork and piping fits and no conflicts exist.

G. Indicate layout of piping and sprinkler locations coordinated with ceiling type, lighting, structural and mechanical. Conform to symmetrical spacing of heads and integrate into locations of lights and other ceiling devices. Center heads on ceiling tiles (+/- 1") and align in straight rows.

H. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Include building sections and a plot plan showing location of underground supply connections, outside control valves, fire department connections and other equipment to be used.

I. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation layout, mounting and support details, and piping connections.

J. Indicate layout of flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

K. Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

L. Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation.

M. Indicate system controls.

N. Submit shop drawings for the following required fire protection system(s) through local jurisdiction for plan approval prior to installation:
   1. Automatic Sprinkler – Plans shall include water supply information from a recent (within five years) flow test in close proximity to the project site and

in the same pressure zone and on the main to be tapped for sprinkler protection.

2. Fire alarm, as required.

1.6 FIRE SPRINKLER PERMIT

A. Fire Sprinkler contractor shall prepare all documents for permit application, submit and obtain the permit from reviewing authority. All costs and fees to obtain the permit shall be paid by the Fire Sprinkler Contractor.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 13 and Local and/ or State Fire Marshal.

B. Perform work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. CPVC fire sprinkler piping located in plenums: Peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet when tested in accordance with UL 1887.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years of continuous representation, a stocking distributor and service representative in the State of Washington.

B. Contractor: Licensed and regularly engaged in the specialized design and installation of automatic sprinkler equipment as listed by UL or other nationally recognized testing laboratories. Minimum three years' experience and have installed at least five systems of comparable size.

C. Bids by wholesalers, suppliers or any firm whose principal business is not that of manufacturing and/or installing fire protection systems are not acceptable.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Furnish cast iron and steel valves with temporary protective coating with end caps and closures on piping and fittings. Maintain in place until installation.

C. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

1.10 FIELD MEASUREMENTS

A. Where the word 'verify' is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

B. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is

responsible for locating, uncovering, disposing of or maintaining existing systems.

1.11 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Mechanical drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

D. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

E. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

F. Prior to ordering equipment cross-check mechanical and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

G. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

H. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

I. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device of fixture roughed in improperly and not positioned on implied centerlines or as required by good practice must be repositioned at no cost to the Owner.

1.12 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.13 SALVAGE

A. Remove excess piping and plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor’s Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

1.14 EXTRA MATERIALS

A. Provide extra sprinklers under provisions of NFPA 13R.

B. Furnish suitable wrenches for each sprinkler type.

C. Furnish metal storage cabinet adjacent to alarm valve. Lettered "Automatic Sprinklers - Reserve Supplies."

1.15 FINAL APPROVAL

A. Completion and approval of the following is required for final approval of systems.
1. Execution of Architect's and Engineer’s final observation reports
2. Operation and maintenance instruction
3. Operation and maintenance manuals submitted
4. Equipment cleaning
5. Record drawings submitted

B. See Division 01.

1.16 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of mechanical systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and

systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier’s or manufacturer’s personnel, those personnel should also provide training on that equipment.

E. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
   1. Provide documentation of all instruction which includes:
      a. Date and time of instruction
      b. Name, affiliation and qualifications of the instructor
      c. Name and affiliation of the attendees
      d. Topics, systems, and equipment covered
      e. Length of instruction

F. Minimum duration of instruction period is 2 hours.

1.17 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, one PDF and one bound copy of operating and maintenance manuals to include the following:
   1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   2. Warranty service contractors' names, address and phone numbers (if different from above).
   3. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data.
   4. Test data log.
   5. Manufacturer's cuts and rating tables, including brochures for all submittal items.
   6. Part numbers of all replaceable items.
   7. Control diagrams and operation sequence.
   8. Written guarantees.
   9. Record drawings corrected and completed.
   10. Completed equipment start-up forms and checklists.

B. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.

C. Imprint on cover:
   1. Name of project.
   2. Owner.
   3. Location of project.
   4. Architect.
   5. Contractor.
   6. Year of completion.

D. Imprint on backing:

1. Name of project.
2. Year of completion.

E. Submittals:
1. Preliminary Copies: Prior to scheduled completion of the project, provide one PDF copy for review by the Architect.
2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

1.18 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary before owner occupancy.

C. Clean exterior of all exposed pipe.

D. Flush entire piping system of foreign matter.

E. Materials intended for use inside the building envelope, including those used for patching, painting, touch-up, and cleaning, must contain acceptable levels of VOC's and contain no added urea-formaldehyde.

1.19 RECORD DRAWINGS

A. See Division 1.

B. Submit two digital files with all drawings in PDF and AutoCAD format.

C. Show location of equipment and size of piping. Where appropriate provide tag or label identification for all valves and similar equipment. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

1.20 TESTING

A. Provide completed start-up forms and checklists.

1.21 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

B. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect such condition is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment he has furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

E. Make all necessary adjustments during first year of operation.

F. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to Local Fire Marshal: If additional drawing submittals are required at any time during construction contractor shall prepare and submit drawings, review with Fire Marshal, and pick up subsequent approved drawings.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Verify devices are installed and connected to fire alarm system.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 EXPANSION AND SEISMIC DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees F.
2. Fire Protection System Temperature: 90 degrees F.
3. Safety Factor: 30 percent.

C. Seismic performance: Provide seismic restraint in compliance with local jurisdiction and IBC 1613 requirements.

1.2 QUALITY ASSURANCE

A. Through penetration firestopping of fire rated assemblies: ASTM E814 with 0.10” w.g. minimum positive pressure differential. Minimum 1-hour protection.

B. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Perform work in accordance with local jurisdiction’s requirements and AWS D1.1 for welding hanger and support attachments to building structure.

D. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 BURIED PIPING

**A. Note that piping from a combination meter to the RPBP must be in piping suitable for domestic water (i.e., stainless steel).**

B. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASTM A234, wrought carbon steel and alloy steel; with half-lapped 10 mil polyethylene tape.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings.
3. Joints: AWS D1.1, welded.

4. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

C. Copper Tubing: Type K annealed. ASTM B75, ASTM B88, ASTM B251.
1. Fittings: Cast copper alloy ASME B16.18; wrought copper and bronze, ASME B16.22. Pressure type solder joint.
2. Joints: Silver braze, AWS A5.8 Classification BCuP-3 or BCuP-4; Solder, ASTM B32 Grade 95TA.
3. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black; Schedule 10 UL listed light wall; ASTM A-795 Type E, Grade A Eddy-Flow or Dyna-Flow UL listed thin wall flow pipe.
1. Steel Fittings: ASME 16.9, wrought steel, butt welded; ASME B16.25, butt weld; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Victaulic, Gruvlok or approved equal.

B. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 [10] galvanized. Use only for dry-pipe sprinkler system and dry standpipes.
1. Steel Fittings: ASME 16.9, wrought steel, butt welded; ASME B16.25, butt weld; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded.
4. Mechanical Grooved Couplings: Malleable galvanized housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Victaulic, Gruvlok or approved equal.

C. Steel Pipe: ASTM A135 Grade A, UL threadable thin wall, black.
1. Cast Iron Fittings: ASME B16.4, threaded fittings.
2. Malleable Iron Fittings: ASME B16.3 threaded type.

D. CPVC Pipe: Harvel “Blazemaster” or approved, 175 psi at 150 degrees F, UL and FM, ASTM F442, SDR 13.5 for fully concealed residential areas only.
1. Fittings: ASTM F438 schedule 40, or ASTM F439 schedule 80, CPVC.
2. Joints: ASTM F493, solvent weld.

2.3 VALVES

A. Manufacturers: UL & FM approved by Nibco, Stockham, Milwaukee or approved equal.

B. Gate Valves:
1. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
2. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends.

C. Ball Valves:
1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded or sweat fitting ends.

D. Butterfly Valves:
1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch where required.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device where required.

E. Check Valves:
1. Up to 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. 2 to 4 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, grooved or flanged ends.

F. Drain Valves:
1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

2.4 BACKFLOW ASSEMBLY

A. Double check valve, detector check or as jurisdiction requires. FDA approved epoxy coated cast iron check valve bodies with bronze seats. Furnish with bronze body ball valve test cocks. Suitable for supply pressures to 175 psi and water temperatures to 140 degrees. Tamper switches on gate valves for monitoring where required by NFPA. Ames, Watts, Apollo, FEBCO, Wilkins or approved.

2.5 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1 to 6 inch: Carbon steel, adjustable swivel, band hanger. Tolco Fig 200 or equal.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.6 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

B. Steel Piping:
1. UL Listed
2. Inner Hose: Stainless Steel.
3. Exterior Sleeve: Braided stainless steel.
4. Joint: Flanged, threaded with union or welded, as specified for pipe joints.
5. Maximum offset: 3/4 inch.

2.7 FLEXIBLE SPRINKLER HOSE CONNECTIONS

A. Manufacturers: FlexHead or approved equal.

B. Performance:
1. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
2. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
3. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

C. Flexible Hose Assemblies and End Fittings:
1. 100% Type 304 Stainless Steel.
2. Straight Hose Assembly or Elbow Hose Assembly.
3. ½ inch or ¾ inch outlet.
4. 175 psi / 300 psi maximum rated pressure.
5. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.

D. Ceiling Bracket:
1. Type G90 Galvanized Steel.
2. Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws.
3. Flexible Hose Attachment: Removable hub type with set screw.

2.8 EXPANSION JOINTS

A. Manufacturers: Metraflex, Mason or approved equal.

2.9 FIRE STOPPING-APPLIED

A. Manufacturers: Dow Corning, 3M Fire Protection, HILTI or approved equal.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.10 FIRE STOPPING-CAST IN PLACE

A. Manufacturers: Presealed Systems "Hydro Flame" or approved equal.

B. General: UL listed system with 3 hour fire rating. Watertight, Class 1 with 3 feet head pressure for 72 hours.

2.11 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.12 MECHANICAL FIRESTOPPING SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal 120 or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking intumescent synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing

rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. UL listed for 2 hour fire protection.

2.13 PIPING ACCESSORIES

A. Manufacturers: Grinnell, EMCO Wheaton, OPW or approved equal.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

C. Swivel Joints: Fabricated steel, bronze, ductile Iron or cast steel body, double ball bearing race, field lubricated, with rubber or Buna-N o-ring seals.

2.14 ELECTRIC HEAT TRACE (Freeze Protection)

A. Manufacturers: Raychem XL-Trace or approved equal.

B. General: Provide a complete UL listed and FM approved system of heating cables, components and control for preventing pipes from freezing.

C. Components: Control enclosures shall be NEMA 4X rated. Connection system shall not require stripping of wires.

D. Control: Thermostatic control with ambient sensor set at 40 F.

E. Installation:
1. Apply "Electric Traced" labels to outside of insulated pipe.
2. Attached cable to metal pipe with glass cloth tape and plastic pipe with aluminum tape.
3. Adjust pipe insulation size to accommodate maintenance tape.
4. Follow manufacturer's installation instructions.
5. Review local jurisdiction requirements before installing.

2.15 PIPE MARKERS

A. Color and Lettering shall conform to ASME A13.1.

B. Fire service piping labels shall be red background with white lettering. Legend shall indicate service of pipe.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## PART 3 EXECUTION

### 3.1 PREPARATION - PIPING

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, unions or grooved couplings.

### 3.2 INSTALLATION - PIPING

A. Install piping in accordance with NFPA 13R for sprinkler systems.

B. Install piping in accordance with NFPA 24 for service mains.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
7. Install copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

O. Install gate, ball, or butterfly valves for shut-off or isolating service.

P. Install drain valves at main shut-off valves, low points of piping and apparatus.

Q. Provide electric heat trace and insulation on wet piping subject to freezing. **Review all requirements of local jurisdiction prior to proceeding. Coordinate with all trades.**

3.3 INSTALLATION – EXPANSION FITTINGS AND LOOPS

A. Install Work in accordance with ASME B31.9.

3.4 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with NFPA 13.

B. Seismic Bracing: Follow NFPA 13 and the following.
1. Bracing shall be bidder designed to resist seismic loading.
2. Provide seismic calculations as required for Ip = 1.5.

3.5 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

C. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items requiring firestopping.

D. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings. Primers must comply with VOC limits per Green Seal standards GS-03 (1997), GS-11 (1993), or SCAQMD Rule #1113 (2004).

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Clean adjacent surfaces of firestopping materials.

G. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and/or roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

H. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
2. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

## 3.6 INSTALLATION - IDENTIFICATION

A. Identification is not required on sprinkler branch lines and run-outs to heads.

B. Identification is required on:
1. Bulk mains
2. Incoming fire service
3. FDC piping

C. Identify service and flow direction (and pressure where more than one pressure is used). Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Install a minimum of one label for each story traversed by piping.

D. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

## 3.7 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

END OF SECTION

SECTION 211313

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system design, installation, and certification.

1.2 SYSTEM DESCRIPTION

A. The fire sprinkler system is to be design-build, but in conformance with conceptual information shown on the drawings.

B. This section requires design and installation of wet pipe sprinkler systems for building fire protection. For areas subject to freezing, see “Dry-Pipe Sprinkler Systems” Section for design and installation of dry pipe sprinkler systems.

C. Provide hydraulically designed system to NFPA 13R occupancy requirements.

D. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.

E. Provide fire department connections. Note if location(s) are indicated on Drawings.

F. Fire suppression system shall not contain ozone depleting substances such as halons, CFC’s and HCFC’s.

PART 2 PRODUCTS

2.1 SPRINKLERS **(Coordinate all head types and finishes with Architect)**

A. Manufacturers: Tyco, Reliable, Viking or approved equal.

B. Provide “quick response” heads in all residential occupancies.

C. Provide “quick response” heads in all light hazard occupancies.

D. GWB Ceiling Type:
1. Type: Concealed pendant type with matching escutcheon plate.
2. Sprinkler and escutcheon plate finish: White enamel factory finish.
3. Fusible link: Glass bulb type temperature rated for specific area hazard.

E. Exposed Area Type:
1. Type: Standard upright type.
2. Finish: Brass

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

F. Side wall Type:
1. Type: Semi-recessed horizontal side wall type.
2. Sprinkler and escutcheon plate finish: White enamel factory finish.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

G. Guards: Finish matching sprinkler finish.

2.2 FIRE DEPARTMENT CONNECTION

A. Manufacturer: Potter-Roemer or approved equal.

B. Wall Type: Cast brass flush mounted wall type with brass or chrome plated finish.

C. Post Type: Free standing type with ductile iron pedestal brass \ chrome plated \ red enamel finish. Final coordination with Civil.

D. Threaded Inlets: Two-way 2-1/2" connections with fire department threads. Threaded cast brass plug and chain of matching material and finish.

E. Storz Inlet: Hard coated aluminum with blind cap and chain.

F. Drain: 3/4-inch automatic drip, outside or connect to drain.

G. Label: “Sprinkler - Fire Department Connection".

2.3 INDICATOR VALVE

A. Provide post or wall indicator valve if required by local authorities.

B. Wall type: Approved by FM and UL listed. Interior gate valve with exterior wheel handle and “open-shut” indicator. Provide tamper switch.

C. Post type: Approved by FM and UL listed. Buried gate valve with “open-shut” indicator. Provide tamper switch.

D. If a remote post indicator valve is required, the fire protection contractor shall as a minimum include an allowance for this work and shall coordinate with civil.

2.4 PIPING SPECIALTIES

A. Alarm valve: Bronze main seat and rubber-faced clapper; unit to include retarding chamber, auxiliary valve, electric alarm pressure switch, valve drain, pressure gauges each side of valve, and miscellaneous fitting and interconnecting pipe. Simplex/Grinnell, Viking, or approved equal.

B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Controls: Supervisory switches. Coordinate with fire alarm section of work.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13R.

B. Install pressure gauges on each side of sprinkler alarm valve.

C. Install approved backflow assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm on building exterior wall.

F. Place pipe runs to minimize obstruction to other work.

G. It shall be a specific requirement that insofar as possible, all sprinkler system mains and branches shall be installed as close as possible to the structural members, not the ceiling.

H. Install main piping in concealed spaces above finished ceilings or soffits; branch piping in joist space or other concealed space to sprinkler heads.

I. Center sprinklers in two directions in rooms as much as reasonable and install piping offsets.

J. Install guards on sprinklers exposed to potential damage.

K. Provide drains at system low points.

L. Hydrostatically test entire system.

M. Testing must be witnessed by Authorities having jurisdiction.

3.2 CLEANING

A. Flush entire piping system of foreign matter.

## 3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 EXPANSION AND SEISMIC DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees F.
2. Fire Protection System Temperature: 90 degrees F.
3. Safety Factor: 30 percent.

C. Seismic performance: Provide seismic restraint in compliance with local jurisdiction and IBC 1613 requirements.

1.2 QUALITY ASSURANCE

A. Through penetration firestopping of fire rated assemblies: ASTM E814 with 0.10” w.g. minimum positive pressure differential. Minimum 1-hour protection.

B. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Perform work in accordance with local jurisdiction’s requirements and AWS D1.1 for welding hanger and support attachments to building structure.

D. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 BURIED PIPING

**A. Note that piping from a combination meter to the RPBP must be in piping suitable for domestic water (i.e., stainless steel).**

B. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASTM A234, wrought carbon steel and alloy steel; with half-lapped 10 mil polyethylene tape.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings.
3. Joints: AWS D1.1, welded.

4. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

C. Copper Tubing: Type K annealed. ASTM B75, ASTM B88, ASTM B251.
1. Fittings: Cast copper alloy ASME B16.18; wrought copper and bronze, ASME B16.22. Pressure type solder joint.
2. Joints: Silver braze, AWS A5.8 Classification BCuP-3 or BCuP-4; Solder, ASTM B32 Grade 95TA.
3. Protection: ASME C105 polyethylene jacket with heat shrink sleeves or double layer, half-lapped 10 mil polyethylene tape to 6" above grade.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 black; Schedule 10 UL listed light wall; ASTM A-795 Type E, Grade A Eddy-Flow or Dyna-Flow UL listed thin wall flow pipe.
1. Steel Fittings: ASME 16.9, wrought steel, butt welded; ASME B16.25, butt weld; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Victaulic, Gruvlok or approved equal.

B. Steel Pipe: ASTM A53 Grade B, ASTM A135, ASTM A795 Schedule 40 [10] galvanized. Use only for dry-pipe sprinkler system and dry standpipes.
1. Steel Fittings: ASME 16.9, wrought steel, butt welded; ASME B16.25, butt weld; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1 flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded.
4. Mechanical Grooved Couplings: Malleable galvanized housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers. Victaulic, Gruvlok or approved equal.

C. Steel Pipe: ASTM A135 Grade A, UL threadable thin wall, black.
1. Cast Iron Fittings: ASME B16.4, threaded fittings.
2. Malleable Iron Fittings: ASME B16.3 threaded type.

D. CPVC Pipe: Harvel “Blazemaster” or approved, 175 psi at 150 degrees F, UL and FM, ASTM F442, SDR 13.5 for fully concealed residential areas only.
1. Fittings: ASTM F438 schedule 40, or ASTM F439 schedule 80, CPVC.
2. Joints: ASTM F493, solvent weld.

2.3 VALVES

A. Manufacturers: UL & FM approved by Nibco, Stockham, Milwaukee or approved equal.

B. Gate Valves:
1. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.
2. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends.

C. Ball Valves:
1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded or sweat fitting ends.

D. Butterfly Valves:
1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch where required.
2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device where required.

E. Check Valves:
1. Up to 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. 2 to 4 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, grooved or flanged ends.

F. Drain Valves:
1. Compression Stop: Bronze with hose thread nipple and cap.
2. Ball Valve: Brass with cap and chain, 3/4 inch hose thread.

2.4 BACKFLOW ASSEMBLY

A. Double check valve, detector check or as jurisdiction requires. FDA approved epoxy coated cast iron check valve bodies with bronze seats. Furnish with bronze body ball valve test cocks. Suitable for supply pressures to 175 psi and water temperatures to 140 degrees. Tamper switches on gate valves for monitoring where required by NFPA. Ames, Watts, Apollo, FEBCO, Wilkins or approved.

2.5 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1 to 6 inch: Carbon steel, adjustable swivel, band hanger. Tolco Fig 200 or equal.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.6 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

B. Steel Piping:
1. UL Listed
2. Inner Hose: Stainless Steel.
3. Exterior Sleeve: Braided stainless steel.
4. Joint: Flanged, threaded with union or welded, as specified for pipe joints.
5. Maximum offset: 3/4 inch.

2.7 FLEXIBLE SPRINKLER HOSE CONNECTIONS

A. Manufacturers: FlexHead or approved equal.

B. Performance:
1. FM Approved for its intended use pursuant to FM 1637 Approval Standard for Flexible Sprinkler Hose with Threaded End Fittings.
2. UL Listed for its intended use pursuant to UL 2443 Standard for Flexible Sprinkler Hose with Fittings for Fire Protection Service.
3. Seismically qualified for use pursuant to ICC-ES AC-156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

C. Flexible Hose Assemblies and End Fittings:
1. 100% Type 304 Stainless Steel.
2. Straight Hose Assembly or Elbow Hose Assembly.
3. ½ inch or ¾ inch outlet.
4. 175 psi / 300 psi maximum rated pressure.
5. Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal corrugated hose diameter.

D. Ceiling Bracket:
1. Type G90 Galvanized Steel.
2. Direct attachment type, having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws.
3. Flexible Hose Attachment: Removable hub type with set screw.

2.8 EXPANSION JOINTS

A. Manufacturers: Metraflex, Mason or approved equal.

2.9 FIRE STOPPING-APPLIED

A. Manufacturers: Dow Corning, 3M Fire Protection, HILTI or approved equal.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.10 FIRE STOPPING-CAST IN PLACE

A. Manufacturers: Presealed Systems "Hydro Flame" or approved equal.

B. General: UL listed system with 3 hour fire rating. Watertight, Class 1 with 3 feet head pressure for 72 hours.

2.11 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.12 MECHANICAL FIRESTOPPING SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal 120 or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking intumescent synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing

rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. UL listed for 2 hour fire protection.

2.13 PIPING ACCESSORIES

A. Manufacturers: Grinnell, EMCO Wheaton, OPW or approved equal.

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

C. Swivel Joints: Fabricated steel, bronze, ductile Iron or cast steel body, double ball bearing race, field lubricated, with rubber or Buna-N o-ring seals.

2.14 ELECTRIC HEAT TRACE (Freeze Protection)

A. Manufacturers: Raychem XL-Trace or approved equal.

B. General: Provide a complete UL listed and FM approved system of heating cables, components and control for preventing pipes from freezing.

C. Components: Control enclosures shall be NEMA 4X rated. Connection system shall not require stripping of wires.

D. Control: Thermostatic control with ambient sensor set at 40 F.

E. Installation:
1. Apply "Electric Traced" labels to outside of insulated pipe.
2. Attached cable to metal pipe with glass cloth tape and plastic pipe with aluminum tape.
3. Adjust pipe insulation size to accommodate maintenance tape.
4. Follow manufacturer's installation instructions.
5. Review local jurisdiction requirements before installing.

2.15 PIPE MARKERS

A. Color and Lettering shall conform to ASME A13.1.

B. Fire service piping labels shall be red background with white lettering. Legend shall indicate service of pipe.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## PART 3 EXECUTION

### 3.1 PREPARATION - PIPING

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges, unions or grooved couplings.

### 3.2 INSTALLATION - PIPING

A. Install piping in accordance with NFPA 13R for sprinkler systems.

B. Install piping in accordance with NFPA 24 for service mains.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:
1. Install in accordance with NFPA 13.
2. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
7. Install copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.

M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

O. Install gate, ball, or butterfly valves for shut-off or isolating service.

P. Install drain valves at main shut-off valves, low points of piping and apparatus.

Q. Provide electric heat trace and insulation on wet piping subject to freezing. **Review all requirements of local jurisdiction prior to proceeding. Coordinate with all trades.**

3.3 INSTALLATION – EXPANSION FITTINGS AND LOOPS

A. Install Work in accordance with ASME B31.9.

3.4 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with NFPA 13.

B. Seismic Bracing: Follow NFPA 13 and the following.
1. Bracing shall be bidder designed to resist seismic loading.
2. Provide seismic calculations as required for Ip = 1.5.

3.5 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

C. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items requiring firestopping.

D. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings. Primers must comply with VOC limits per Green Seal standards GS-03 (1997), GS-11 (1993), or SCAQMD Rule #1113 (2004).

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Clean adjacent surfaces of firestopping materials.

G. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and/or roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

H. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
2. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

## 3.6 INSTALLATION - IDENTIFICATION

A. Identification is not required on sprinkler branch lines and run-outs to heads.

B. Identification is required on:
1. Bulk mains
2. Incoming fire service
3. FDC piping

C. Identify service and flow direction (and pressure where more than one pressure is used). Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Install a minimum of one label for each story traversed by piping.

D. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

## 3.7 INTERFACE WITH OTHER PRODUCTS

A. Inserts:
1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

END OF SECTION

SECTION 211313

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system design, installation, and certification.

1.2 SYSTEM DESCRIPTION

A. The fire sprinkler system is to be design-build, but in conformance with conceptual information shown on the drawings.

B. This section requires design and installation of wet pipe sprinkler systems for building fire protection. For areas subject to freezing, see “Dry-Pipe Sprinkler Systems” Section for design and installation of dry pipe sprinkler systems.

C. Provide hydraulically designed system to NFPA 13R occupancy requirements.

D. Determine volume and pressure of incoming water supply from water flow test data. Revise design when test data become available prior to submittals.

E. Provide fire department connections. Note if location(s) are indicated on Drawings.

F. Fire suppression system shall not contain ozone depleting substances such as halons, CFC’s and HCFC’s.

PART 2 PRODUCTS

2.1 SPRINKLERS **(Coordinate all head types and finishes with Architect)**

A. Manufacturers: Tyco, Reliable, Viking or approved equal.

B. Provide “quick response” heads in all residential occupancies.

C. Provide “quick response” heads in all light hazard occupancies.

D. GWB Ceiling Type:
1. Type: Concealed pendant type with matching escutcheon plate.
2. Sprinkler and escutcheon plate finish: White enamel factory finish.
3. Fusible link: Glass bulb type temperature rated for specific area hazard.

E. Exposed Area Type:
1. Type: Standard upright type.
2. Finish: Brass

3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

F. Side wall Type:
1. Type: Semi-recessed horizontal side wall type.
2. Sprinkler and escutcheon plate finish: White enamel factory finish.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

G. Guards: Finish matching sprinkler finish.

2.2 FIRE DEPARTMENT CONNECTION

A. Manufacturer: Potter-Roemer or approved equal.

B. Wall Type: Cast brass flush mounted wall type with brass or chrome plated finish.

C. Post Type: Free standing type with ductile iron pedestal brass \ chrome plated \ red enamel finish. Final coordination with Civil.

D. Threaded Inlets: Two-way 2-1/2" connections with fire department threads. Threaded cast brass plug and chain of matching material and finish.

E. Storz Inlet: Hard coated aluminum with blind cap and chain.

F. Drain: 3/4-inch automatic drip, outside or connect to drain.

G. Label: “Sprinkler - Fire Department Connection".

2.3 INDICATOR VALVE

A. Provide post or wall indicator valve if required by local authorities.

B. Wall type: Approved by FM and UL listed. Interior gate valve with exterior wheel handle and “open-shut” indicator. Provide tamper switch.

C. Post type: Approved by FM and UL listed. Buried gate valve with “open-shut” indicator. Provide tamper switch.

D. If a remote post indicator valve is required, the fire protection contractor shall as a minimum include an allowance for this work and shall coordinate with civil.

2.4 PIPING SPECIALTIES

A. Alarm valve: Bronze main seat and rubber-faced clapper; unit to include retarding chamber, auxiliary valve, electric alarm pressure switch, valve drain, pressure gauges each side of valve, and miscellaneous fitting and interconnecting pipe. Simplex/Grinnell, Viking, or approved equal.

B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Controls: Supervisory switches. Coordinate with fire alarm section of work.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13R.

B. Install pressure gauges on each side of sprinkler alarm valve.

C. Install approved backflow assembly at sprinkler system water source connection.

D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

E. Locate outside alarm on building exterior wall.

F. Place pipe runs to minimize obstruction to other work.

G. It shall be a specific requirement that insofar as possible, all sprinkler system mains and branches shall be installed as close as possible to the structural members, not the ceiling.

H. Install main piping in concealed spaces above finished ceilings or soffits; branch piping in joist space or other concealed space to sprinkler heads.

I. Center sprinklers in two directions in rooms as much as reasonable and install piping offsets.

J. Install guards on sprinklers exposed to potential damage.

K. Provide drains at system low points.

L. Hydrostatically test entire system.

M. Testing must be witnessed by Authorities having jurisdiction.

3.2 CLEANING

A. Flush entire piping system of foreign matter.

## 3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

END OF SECTION

SECTION 220000

# PLUMBING GENERAL CONDITIONS

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Division 22.

### 1.2 SUMMARY

A. Design Intent: Provide complete plumbing systems for residential buildings. See architectural site plan for building locations.

B. Provide labor, materials and appliances necessary for satisfactory installation of mechanical work ready to operate in strict accordance with these specifications and drawings. Work of Division 22 includes, but is not limited to, that as delineated in the following specification sections:

22 00 00 Plumbing General Conditions

22 05 00 Plumbing Common Work Results

22 07 00 Plumbing Insulation

22 11 00 Facility Water Distribution

22 13 00 Facility Sanitary Sewerage

22 30 00 Plumbing Equipment

22 40 00 Plumbing Fixtures

### 1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over mechanical installations.
1. Uniform Plumbing Code (UPC) with local amendments.
2. 2018 International Mechanical Code (IMC) with local amendments.
3. 2018 International Residential Code (IBC) with local amendments.
4. 2018 Washington State Residential Energy Code (WSREC) with local amendments.
5. International Fuel Gas Code (IFGC) with local amendments.
6. 2020 National Electrical Code (NEC) NFPA 70.
7. Requirements of OSHA and EPA.
8. National Fire Protection Association (NFPA) Codes and Standards.
9. ASME code for construction of pressure vessels.
10. American Gas Association (AGA) Standards.

11. Evergreen Sustainable Development Standard (ESDS) version 4.0.
12. ASTM, ANSI and NEMA standards, as referenced in subsequent sections.
13. Local Sewer District Requirements.
14. Local Water District Requirements.
15. Local Health Department Requirements.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, FM and UL for fire resistance ratings and surface burning characteristics.

B. Provide vibration isolation on motor driven equipment 0.5 hp or more, plus connected piping.

1.5 PRODUCT SUBSTITUTIONS:

A. Manufacturers and models of equipment and material indicated herein and on drawings are those upon which mechanical design is based. Other manufacturers with products considered equal in general quality may be listed without specific model designation. Manufacturers not listed must be submitted for approval.

B. Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

C. Any equipment other than the basis of design is considered a substitution.

D. In selecting substitute equipment, the Contractor is responsible for and must guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Unless indicated otherwise, "or approved" may be assumed for all products in Division 22.

1.6 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 22 and all additional products noted on drawings or required for completion of sequence of operations.

B. **Submittals shall be complete in one PDF file with bookmarks for each Division. Multi-part submittals will be returned without review.**
1. First Page: Name of Project, Owner, Location & Contracting Company.
2. Index Page: List of specification sections with contents by Tag or item.
3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

C. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

D. Equipment vendor cover page with contact information shall precede submittal by that vendor.

E. Submitted product information shall include (as applicable) but not be limited to the following information:
1. Product description
2. Manufacturer and model
3. Dimensions
4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
5. Construction Materials
6. Ratings (i.e. UL, ASTM, NEMA, etc)
7. Electrical data
8. Sound level data (corresponding to scheduled values)
9. Vibration Isolation
10. Controls and wiring diagrams
11. Accessories
12. Engineering technical data (i.e. pressure drops, leakage rates, pump curves)

F. If requested by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

G. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

1.7 PLUMBING PERMIT

A. Plumbing contractor shall prepare all documents for plumbing permit application, submit for and obtain the permit. All costs and fees to obtain the permit shall be paid by the Plumbing Contractor.

B. Contractor shall not commence work until permit is obtained. Contractor is solely responsible to insure that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 – Building Services Piping for installation of piping systems and ASME Section IX – Welding and Brazing Qualifications for welding materials and procedures.

B. Perform Work in accordance with the Uniform Plumbing Code including State and local amendments.

C. Provide products requiring electrical connections listed and classified by UL as suitable for purpose specified and indicated.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect all equipment, materials, and insulation from weather, construction traffic, dirt, water, chemicals, and damage by storing in original packaging and under cover. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

C. Inspect all products and materials for damage prior to installation.

D. Protect piping from all entry of foreign materials by providing temporary end caps or closures on piping and fittings. Furnish temporary protective coating on cast iron and steel valves.

E. Protect heat exchangers and tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

H. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Provide ventilation in areas to receive solvent cured materials.

C. Do not install underground piping or valves when bedding is wet or frozen.

D. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer. Maintain temperature during and after installation for minimum period of 24 hours.

E. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify by field measurements, sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

1.13 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. Plumbing drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

E. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

F. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

G. Prior to ordering equipment cross-check plumbing and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

H. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

I. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

J. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or fixture roughed in improperly and not positioned on implied centerlines or as required by good practice must be repositioned at no cost to the Owner.

K. Where the word 'verify' is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

M. Coordinate wall openings, piping rough-in locations, concrete housekeeping pads, and electrical rough-in locations to accommodate Work of this Section.

1.14 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of plumbing work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.15 SALVAGE

A. Remove excess piping and plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan.

1.16 ELECTRICAL

A. Motors:
1. All motor efficiencies shall conform to Washington State Energy Code and NEMA MG-1.

B. Power Wiring: By Electrical Contractor.

C. Control Wiring: Responsibility of Division 22, including all line and low voltage control wiring. Owner will not entertain additional cost due to lack of coordination between Plumbing Contractor and Electrical Contractor.

1.17 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout.
   1. Execution of Architect's and Engineer's final observation reports (punchlist)
   2. Operating and Maintenance Instructions
   3. Operating and Maintenance Manual
   4. Equipment and Pipe Cleaning
   5. Record Drawings
   6. Testing
   7. Warranty

B. See Division 01 for additional requirements.

1.18 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of plumbing systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.

E. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
   1. Provide documentation of all instruction which includes:
      a. Date and time of instruction
      b. Name, affiliation and qualifications of the instructor
      c. Name and affiliation of the attendees
      d. Topics, systems, and equipment covered
      e. Length of instruction

F. Minimum duration of instruction periods:
   1. Plumbing Systems 4 hours

## 1.19 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, one PDF and one bound copy of operating and maintenance manuals to include the following:
   1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   2. Warranty service contractors' names, address and phone numbers (if different from above).
   3. Manufacturer's cuts and rating tables, including brochures for all submittal items.
   4. Part numbers of all replaceable items.
   5. Control diagrams and operation sequence.
   6. Written guarantees.
   7. Record drawings corrected and completed.
   8. Completed equipment start-up forms and checklists.

B. Operation and Maintenance Data:
   1. Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.
   2. Submit fixture, trim, exploded view and replacement parts lists.
   3. Submit replacement part numbers and availability, and nearest service depot location and telephone number.

C. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.

D. Imprint on cover:
   1. Name of project.
   2. Owner.
   3. Location of project.
   4. Architect.
   5. Contractor.
   6. Year of completion.

E. Imprint on backing:
   1. Name of project.
   2. Year of completion.

F. Submittals:
   1. Preliminary Copies: Prior to scheduled completion of the project, submit one PDF copy for review by the Architect.
   2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

## 1.20 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe and equipment. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary again before owner occupancy.

C. Clean exterior of all exposed pipe and equipment.

1.21 RECORD DRAWINGS

A. Submit one digital file with all drawings in PDF format.

B. Show location of equipment, location and size of piping. Locate all valves and similar equipment with tag or label identification. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

C. Record actual locations of equipment, clean-outs, controlling devices, and all above grade, under-floor, and buried piping.

1.22 TESTING

A. Provide completed start-up forms and checklists.

B. Coordinate Test and Balance with Division 23 05 93. Provide all necessary assistance and documentation.

1.23 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees that exceed one year (e.g.: water heaters).

E. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. Engineer will revise and/or prepare drawings for submittal.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

3.3 FIELD QUALITY CONTROL

A. Inspect installed fire stopping for compliance with specifications and submitted schedule.

B. Inspect isolated equipment after installation for proper movement clearance.

C. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction.

D. Test sanitary waste and vent piping system in accordance with applicable code and local authority having jurisdiction.

E. Test storm drainage piping system in accordance with applicable code and local authority having jurisdiction.

3.4 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean plumbing fixtures and equipment.

C. Use acceptable cleaning products per IAQ Management Plan.

3.5 MANUFACTURER'S FIELD SERVICES

A. Where PEX tubing or seismic joints are installed, furnish inspection services by manufacturer's representative and certify installation is in accordance with manufacturer's recommendations and equipment is performing satisfactorily.

3.6 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

B. Do not permit use of plumbing fixtures before final acceptance.

END OF SECTION

SECTION 22 05 00

# COMMON WORK RESULTS FOR PLUMBING

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Comply with requirements and recommendations of Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58 and SP-69.

B. Comply with Federal "Reduction of Lead in Drinking Water Act" – 2011. Pipes, pipe fittings, plumbing fittings and fixtures shall be "Lead Free" meaning not more than a weighted average of 0.25% lead in wetted surfaces.

### 1.2 SCOPE

A. This section includes products, assemblies and methods applicable to more than one of the systems specified in the following sections of Division 22.

### 1.3 MATERIALS AND EQUIPMENT

A. Where two or more units of same class of equipment are required, use products of a single manufacturer. All equipment shall be new and free from damage.

B. Provide major equipment components with manufacturer's name, address, catalog number and capacity indicated on a nameplate, securely affixed in a conspicuous place.

C. Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

### 1.4 QUALITY ASSURANCE

A. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform work in accordance with local jurisdiction’s requirements and AWS D1.1 for welding hanger and support attachments to building structure.

## PART 2 PRODUCTS

### 2.1 GENERAL VALVE REQUIREMENTS

A. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted. Brass valves are not permitted.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 GATE VALVES

A. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.

B. 4 inches and Smaller: Use ball valve or butterfly valve in lieu of gate valve.

2.3 BALL VALVES

A. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.

B. 2 inches and Smaller: Lead-Free, NSF-61-8, UPC-IGC-157, MSS SP 110, 600 psi WOG, two piece silicon performance bronze body, bronze trim, bronze ball, full port, PTFE seats, blow-out proof stem, solder or threaded ends with union, lever handle. For insulated piping provide 2" extended handles of non-thermal conductive material. Nibco Model T/S-585-80-LF.

2.4 CHECK VALVES

A. Swing Check Valves:
1. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham or approved equal.
2. 2 inches and Smaller: Lead-Free, NSF-61-8, MSS SP 80, 200 psi CWP, silicone performance bronze body and cap, bronze disc with PTFE seat, Y-pattern design, solder or threaded ends. Nibco Model T/S-413-Y-LF.
3. 2-1/2 inches and Larger: Lead-Free, NSF-61-8, MSS SP 71, Class 125, 200 psi CWP, cast iron body, bronze trim, bronze disc and seat, flanged ends. Nibco Model F-910-LF.

B. Spring Loaded Check Valves:
1. Manufacturers: NIBCO or equal by Apollo, Hammond, Milwaukee, Stockham, Titan or approved equal.
2. 2 inches and Smaller: Lead-Free, NSF-61-8, MSS SP 80, 250 psi CWP, silicone performance bronze body, in-line spring lift check, silent closing, PTFE disc, integral seat, solder or threaded ends. Nibco Model T/S-480-Y-LF.
3. 2-1/2 inches and Larger: Lead-Free, NSF-61-8, MSS SP 71, Class 125, 200 psi CWP, wafer style, cast iron body, Buna-N bonded to bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends. Nibco Model F-910-LF.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports with incompressible insulation inserts and shields for all piping to be insulated per 220700.

1. Manufacturer: Pipe Shields, INC or approved equal.
2. Material: Calcium Silicate or Uretherne per temperature application.
3. Thickness: Insert thickness shall match required insulation thickness per 220700.

B. Plumbing Piping - DWV: Cast-iron or PVC
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water: Copper
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring, with rigid insulation inserts.
2. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis, with rigid insulation inserts and saddle.
3. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis, with rigid insulation inserts and saddle.
4. Vertical Support: Steel riser clamp.
5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
7. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. Secondary Pipe Positioning and Supports:
1. Makeshift, field devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. Hubbard "HOLDRITE" support systems or approved equal.
2. For vertical mid-span supports of piping 4” and under, use HOLDRITE Stout Brackets™ with HOLDRITE Stout Clamps or two-hole pipe clamps (MSS Type 26).
3. For plenum applications use pipe supports that meet ASTM E-84 25/50 standards, such as the HOLDRITE Flame Fighter™ or approved equal.

## 2.6 HANGER ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.7 ACCESS PANELS

A. Milcor or approved equal.

B. Include an allowance for a minimum of 8 access panels.

C. Architectural grade, 14 guage frame and door, painted steel or stainless steel based on application.

2.8 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, 300 psi CWP, malleable iron, threaded.
2. Copper Piping: Class 150, 300 psi CWP, bronze unions.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. PVC Piping: PVC.
5. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, 300 psi CWP, forged steel, slip-on flanges.
2. Copper Piping: Class 150, 300 psi CWP, slip-on bronze flanges.
3. PVC Piping: PVC flanges.
4. CPVC Piping: CPVC flanges.
5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or Schedule 80 threaded PVC pipe (ASTM D2464).

2.9 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Metraflex, Mason or approved equal.

2.10 EXPANSION JOINTS

A. Manufacturers: Metraflex, Mason or approved equal.

2.11 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Metal Counterflashing: 22 gage galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.12 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sealant: Acrylic

D. Size large enough to allow for movement due to expansion and to provide for continuous insulation or installation of fire sealant at fire-rated walls. Note that insulation is discontinuous at fire walls.

2.13 MECHANICAL SLEEVE SEALS

A. Manufacturers: Metraflex Metraseal, Thunderline Link-Seal or approved equal.

2.14 ELECTRIC HEAT TRACE (Freeze Protection)

A. Manufacturers: Raychem XL-Trace or approved equal.

B. General: Provide a complete UL listed system of heating cables, components and control for preventing pipes from freezing.

C. Cable: Self-regulating cable with nickel-copper bus wires embedded in conductive polymer core with dielectric polyolefin jacket, braided tinned copper ground and outer jacket of polyolefin. Cable shall vary power output in response to temperature all along its length with a self-regulating factor of at least 90%.

D. Components: Control enclosures shall be NEMA 4X rated. Connection system shall not require stripping of wires.

E. Control: Thermostatic control with ambient sensor set at 40 F.

F. Installation:
1. Apply "Electric Traced" labels to outside of insulated pipe.
2. Attached cable to metal pipe with glass cloth tape and plastic pipe with aluminum tape.
3. Adjust pipe insulation size to accommodate maintenance tape.
4. Follow manufacturer's installation instructions.

2.15 FIRESTOPPING-APPLIED

A. Manufacturers: RectorSeal, Dow Corning, 3M Fire Protection or approved equal.

B. General:
1. Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by applicable building codes and tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests for through penetrations, and ASTM E 1966 or UL 2079 for construction joints, and UL 2307 for perimeter edge joints.

2. Fire stopping material shall be free of asbestos, PCBs, ethylene glycol, and lead.
3. Do not use any product containing solvents or that requires hazardous waste disposal.
4. Fire stopping shall be performed by a contractor trained or approved by firestop manufacturer.
5. Select products with rating not less than rating of wall or floor being penetrated.

C. Single Source Responsibility: Provide firestop systems for all conditions from a single supplier.

D. Product Description: Provide Latex caulk/sealant, Silicone caulk/sealant, Intumescent Wrap Strip, Firestop Putty, Firestop Collar or Intumescent Sleeve to meet each specific application and performance requirement.

E. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

F. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
1. Forming/Damming Materials: Mineral fiberboard, backer rod or other type recommended by Manufacturer's tested system.

2.16 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches high.

B. Metal Tags: Brass, Aluminum or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges. Plain English designations.

C. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

2.17 PIPE MARKERS

A. Color and Lettering shall conform to ASME A13.1 and UPC. Specific examples are noted in the table below.

| Service | Background Color | Letter Color | Legend |
|---|---|---|---|
| Domestic Cold Water | Green | White | DOMESTIC COLD WATER |
| Domestic Hot Water | Green | White | DOMESTIC HOT WATER |
| Domestic Recirculation | Green | White | DHW RECIRC |
| Tempered Domestic Water | Green | White | TEMPERED WATER |

| | | | |
|---|---|---|---|
| Waste | Black | White | SANITARY SEWER |
| Vent | Black | White | SANITARY VENT |
| Condensate Drain | Black | White | CONDENSATE |
| Storm Drainage | Black | White | STORM |

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.18 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

B. Color code plumbing valves green.

2.19 LOCKOUT DEVICES

A. Lockout Hasps: Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices: Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond of adhesives or firestopping.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

E. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION-CLEARANCE

A. Appliances and equipment shall be accessible for inspection, service, repair and replacement.

B. A minimum of 36” of clearance shall be provided in front of the control side of appliances and equipment. Provide additional space when required by NEC.

3.3 INSTALLATION – ACCESS PANELS

A. Furnish access panels for installation at all concealed equipment which requires service, maintenance or adjustment to include but not limited to equipment, valves, open drains, control valves and controls.

B. Provide location layout and required size for all access panels to general contractor. Layout shall be regular and consistent, maintain a uniform wall panel height of 24” centerline above finished floor, unless noted otherwise.

C. Provide fire rated access panels where installed in fire rated assembly.

D. Provide stainless steel access panels where installed in tile surfaces.

E. Furnish access panels to general contractor for installation.

F. Paint installed access panels to match wall or ceiling. Verify that panels are not painted shut.

3.4 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access panels where valves and fittings are not accessible.

F. Insulate valves according to application in Section 22 07 00.

G. For installation of valves in domestic water systems refer to Section 22 11 00.

3.5 VALVE APPLICATIONS

A. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

B. Install globe valves for throttling, bypass, or manual flow control services.

C. Install spring loaded check valves on discharge of pumps.

3.6 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

F. Adjust hangers and supports as required to bring system to proper line and grade. Piping shall be plumb with floor and parallel/perpendicular to building structure.

G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping, or sheet lead packing between pipe and hanger.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Insulated piping shall have insulation run continuous through hangers and supports with use of rigid inserts. Insulation shall be glued to both sides of insert at hangers and supports, no insulation gaps are allowed. Refer to Section 22 07 00.

L. Support of pipe, tubing and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods shall not be allowed.

M. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

3.7 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with IBC 1613 and ASCE 7.

3.8 INSTALLATION-PIPING PROTECTION

A. Provide protective shield plates in concealed locations where piping, other than cast-iron or steel, is installed in studs, joists or rafters. Plates shall be 16 gage steel and cover the pipe area plus 2”. Shields may be omitted if piping is more than 1-1/2” from nearest edge of structural member.

B. Prevent contact between dissimilar metals, such as copper tubing and steel, by use of copper-plated, plastic coated, or flexible materials. All supports which contact copper tubing shall be copper plated.

3.9 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

B. Construct supports of steel members, formed steel channel or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

C. Provide rigid anchors for pipes after vibration isolation components are installed.

3.10 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.11 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk or fireproof airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.12 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating and to uniform density and texture. Remove dam material after firestopping material has cured.

D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Clean adjacent surfaces of firestopping materials.

G. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and/or roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

H. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   2. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.13 INSTALLATION – VIBRATION ISOLATION

A. Install isolation for motor driven equipment.

3.14 INSTALLATION - IDENTIFICATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Valve Tags: Identify valves in main and branch piping with tags.
   1. Do not provide numbered tags.
   2. Provide tags with plain English description of service and function. i.e. “Domestic Hot Water, Kitchen”

E. Pipe Labels: Identify piping, concealed or exposed, with plastic tape pipe markers.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.

3.15 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by firestoppping material installation.

END OF SECTION

# SECTION 220700

# PLUMBING INSULATION

## PART 1 GENERAL

### 1.1 QUALITY ASSURANCE

A. Provide insulation tested for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. All systems components subject to heat loss or gain, such as, piping, storage tanks, vessels, valves etc. shall be insulated to conform with the 2018 Washington State Residnetial Energy Code and ESDS standards (as minimum).

### 1.2 IDENTIFICATION

A. Insulation shall bear a manufacturer's mark indicating the product R-value or K-value and thickness. This mark shall be visible after installation and shall be repeated at an interval of no more than 10 feet.

## PART 2 PRODUCTS

### 2.1 GLASS FIBER, RIGID

A. Manufacturers: Johns Manville Micro-Lok AP-T Plus or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Rigid, noncombustible. ASTM C547.
1. 'K' factor: 0.23 at 75 degrees F.
2. Fiberglass or Earthwool with ECOSE
3. Maximum Service Temperature: 850 degrees F.
4. Maximum Moisture Absorption: 0.2 percent by volume.
5. Density: 3.0 lb/cu ft.

C. Vapor Retarder Jacket: ASJ+ or Type I, reinforced facing, paintable. Longitudinal acrylic adhesive closure system with factory supplied butt strips. ASTM C1136.

D. Rigid clamp/hanger insert: Preformed, incompressible (Calcium Silicate or similar), matching pipe size and insulation thickness.

### 2.2 GLASS FIBER, BLANKET

A. Manufacturers: Johns Manville Micro-Flex or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Semi-rigid, shot-free, continuous fiber, noncombustible. ASTM C1393.
   1. 'K' factor: 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.
   4. Density: 2.5 lb/cu ft.

C. Vapor Retarder Jacket: Type I, reinforced facing, will accept paint. Seal with pressure sensitive tape. ASTM C1136.

2.3 POLYOLEFIN INSULATION

A. Manufacturers: IMCOA or similar.

B. Polyolefin or Polyethylene pipe insulation is **NOT ACCEPTABLE** for any application.

2.4 ELASTOMERIC CELLULAR FOAM

A. Manufacturers: Armacell AP/Armaflex, Aeroflex Aerocel or approved equal.

B. Preformed flexible, closed-cell, elastomeric thermal insulation: Type I, Tubular form, self-seal or continuous, 25/50-rated, CFC free, low VOC, 'K' factor: 0.27 at 75 degrees F. ASTM C534.

C. Rigid clamp/hanger insert: Armacell Armafix, polyurethane insert and aluminum jacket, single piece with self-adhering closure.

2.5 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Plastic Pipe Jacket:
   1. Product Description: One piece molded type fitting covers and sheet material, off-white color. ASTM D1784.
   2. Thickness: 15 mil indoor, 30 mil outdoor.
   3. Connections: Brush on welding adhesive.

B. Aluminum Pipe Jacket:
   1. Thickness: 0.016 inch thick sheet. ASTM B209.
   2. Finish: Embossed
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Apply insulation when building is thoroughly dry to prevent shrinkage.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulate entire piping system including fittings, valves, unions, flanges, strainers, flexible connections, pump fittings, connections to equipment and expansion joints.

D. Insulate flanges and unions with removable sections and jackets.

E. Piping Inserts and Shields:
1. Insulation shall be continuous through supports and hangers with incompressible inserts and shields. Do not directly clamp/support pipe scheduled to be insulated.

F. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

G. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer.

H. Exposed Equipment: Locate insulation and cover seams in least visible locations.

I. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

3.3 SCHEDULES

A. Piping: Provide on piping as listed below.

| | | **PIPE SIZE** | | | |
|---|---|---|---|---|---|
| **Service** | **Insulation Type** | **<1”** | **1" to 1-1/4”** | **1-1/2" to 4"** | **4" to 8”** |
| Domestic Cold Water | Glass Fiber RIGID | 1/2" | 1/2" | 1/2" | 1/2" |
| Domestic Hot Water (Not Recirculated) | Glass Fiber RIGID | 2" | 2" | 2-1/2" | 2-1/2" |
| Domestic Hot Water Recirc. | Glass Fiber RIGID | 1" | 1" | 1-1/2" | 1-1/2" |
| Condensate Drains | RIGID / FOAM | 1/2" | 1/2" | 1/2" | 1/2" |

1. Do not insulate direct burial cold water.

2. For all exterior piping applications use only Elastomeric Cellular Foam with Aluminum jacket.

END OF SECTION

# SECTION 221100

# FACILITY WATER DISTRIBUTION

## PART 1 GENERAL

### 1.1 SCOPE

A. This section includes hot and cold water supply, equipment and accessories.

### 1.2 GENERAL REQUIREMENTS

A. Comply with Federal "Reduction of Lead in Drinking Water Act" – 2011. Pipes, pipe fittings, plumbing fittings and fixtures shall be "Lead Free" meaning not more than a weighted average of 0.25% lead in wetted surfaces.

### 1.3 SITE MAINS

A. Provide connections to Site water mains as indicated on drawings.

### 1.4 QUALITY ASSURANCE

A. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

B. The mechanical press fitting manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of press fittings and crimping tools. The representative shall periodically visit the jobsite and review installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

## PART 2 PRODUCTS

### 2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: Type K hard drawn or annealed. ASTM B88.
   1. Fittings: ASME B16.22, ASTM B75, wrought copper.
   2. Joints: Brazed
      a. Copper to copper: Silver/phosphorus/copper alloy (15 percent silver). AWS A5.8 BCuP-5.
      b. Copper to brass or steel: AWS Bag-5 Silver (45 percent silver)

### 2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: Type L hard drawn seamless. ASTM B88.
   1. Fittings:
      a. Wrought copper and bronze. ASME B16.22, ASTM B75.

b. Copper press with EPDM O-ring, ASME B16.22, 200 psi.

2. Joints:
   a. Solder, lead free, 95-5 tin-antimony, or tin and silver. ASTM B32.
   b. Press connection, Viega ProPress or approved equal.

B. Copper Tubing: Type L hard drawn, rolled grooved ends. ASTM B88.
1. Copper Grooved-End Fittings: ASME B75 copper tube or bronze ASTM B584 bronze castings, with copper tube dimensioned grooved ends (flaring of tube and fitting ends to IPS dimensions is not permitted).
2. Joints: Grooved mechanical couplings meeting ASTM F1476. Victaulic or approved equal.
   a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron cast with offsetting, angle-pattern bolt pads, copper-colored enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
   b. Gasket: Grade “EHP” EPDM.
   c. Accessories: Steel bolts, nuts, and washers.
   d. Design: “Installation Ready” designed for direct ‘stab’ installation onto roll grooved copper tube without prior field disassembly and no loose parts. Victaulic Style 607 QuickVic™.

C. CPVC Pipe (2" and larger): Schedule 80 CPVC, Charlotte Corzan or approved equal. ASTM D1784, ASTM F441, NSF 61.
1. Fittings: Schedule 80 CPVC. ASTM F439, NSF 61.
2. Joints: Solvent weld with ASTM F493 two-step solvent cement with primer.

D. PEX Domestic Water Pipe
1. Manufacturers: Uponor AquaPEX or equal by Viega. No substitutions permitted.
2. PEX Pipe and Fittings
   a. PEX-1 (Engel-Method Crosslinked Polyethylene) Piping: NSF 61, ASTM 876 and F877.
   b. ProPEX Ring: Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked ASTM F1960.
   c. PEX-a Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
      i. UNS No. C69300 Lead-free (LF) Brass, NSF/ANSI 61.
      ii. Engineered Polymer (EP): UDEL Polysulfone, Radel R Polyphenylsulfone or Acudel modified polyphenylsulfone, ASTM D 6394, NSF/ANSI 61.
   f. Manifolds: Multiple-outlet assembly complying with ASTM F 877; with ASTM F 1960 outlets. Engineered polymer or lead-free copper manifold.
   g. All fittings, valves and pipe supports to be engineered systems by PEX manufacturer.

2.3 TRAP PRIMER PIPING

A. Copper Tubing: ½" Type L soft annealed seamless, ASTM B88
1. Fittings: Flared compression.

B. PEX: ½" Uponor, Viega or approved equal
1. PEX-a (Engel-Method Crosslinked Polyethylene) Piping: NSF 61, ASTM F 876 and F877.

2.4 PRESSURE GAUGES

A. Manufacturers: Marsh, Trerice, Weiss or approved equal.

2.5 PRESSURE GAUGE TAPS

A. Needle Valve: 316 stainless steel, 1/4 inch NPT for minimum 300 psi. Trerice 735.

2.6 STEM TYPE THERMOMETERS

A. Manufacturers: Marsh, Trerice, Weiss or approved equal.

B. Thermometer: Blue appearing organic, lens front tube, cast aluminum case with epoxy finish, adjustable angle. ASTM E1. Trerice AX/BX.
1. Size: 7-inch scale within 7' of floor, 9-inch scale mounted over 7'.
2. Window: Clear.
3. Stem: 304SS, 3/4 inch NPT.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.7 STRAINERS

A. Manufacturers: Apollo/Conbraco, Metraflex, Titan, Nibco or approved equal.

B. 4 inch and Smaller: Threaded or Solder, 400 PSI CWP, lead-free bronze body, Y-pattern with 20 mesh stainless steel perforated screen. Apollo 59LF.

2.8 RESIDENTIAL SUB METER SYSTEM

A. Manufacturer: ista or approved equal.

B. Complete wireless water submetering system using industry-standard, nonproprietary equipment.

C. TapWatch wireless reading system with meter transmitters, area repeaters and data receiver/logger.

2.9 RESIDENTIAL SUB METER (COLD WATER)

A. Manufacturer: Norgas, Master Meter or approved equal.

B. Flexible Axis Meter (FAM) designed for installation at any angle. Exceed AWWA C-708 and C-700 requirements for construction, accuracy, head loss, operating and design criteria. Additional meet NSF-61 requirements for low lead content.

C. Construction:
1. Main Case: SeBiLOY II 86% copper
2. Measuring Chamber: Glass-reinforced Nylon
3. Register: Glass lens, stainless steel case, rubber gasket
4. Maximum Working Pressure: 150 psi
5. Maximum Working Temperate: 1 20 F
6. Maximum Flow Rate: 15 gpm
7. Maximum Pressure Loss at Maximum Flow: 10.9 psi

D. Electronic reader compatible via wireless communication.

2.10 REDUCED PRESSURE BACKFLOW PREVENTERS (RPBA)

A. Manufacturers: Watts or equal by Apollo/Conbraco, Wilkens or approved equal. Must be listed as acceptable by the State of Washington Cross Connection Manual.

B. 2 inches and Smaller: Lead-Free. Comply with ASSE 1013. Cast copper silicone body with internal pressure differential relief valve located between two positive seating captured spring check valves, inlet Y-strainer, inlet and outlet shutoff ball valves, ball valve test cocks, replaceable polymer seats and silicone seat discs, air gap drain fitting, 175 psi working pressure, 33-180 F operating temperature range. Watts model LF919.

C. 2-1/2 inches and Larger: Lead- Free. Comply with ASSE 1013. Ductile iron body with internal pressure differential air-in/water-out relief valve located between two positive seating captured spring check valves, 100% fused epoxy coating inside/outside, epoxy coated inlet Y-strainer, inlet and outlet epoxy coated gate valves, ball valve test cocks, stainless steel internal parts, replaceable stainless steel seats, air gap drain fitting, 175 psi working pressure, 33-110 F operating temperature range. Watts model LF909.

2.11 WATER HAMMER ARRESTORS

A. Manufacturers: Wade, PPP or approved equal.

B. ASSE 1010; stainless steel or copper construction, pre-charged, bellows or piston type sized in accordance with PDI WH-201.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with groove couplings, flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Provide connections to site mains as indicated on drawings.

C. Grade piping at 1/4” per foot where possible, but in no case less than 1/8” per foot. Install all main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

D. Backfill trenching with pea-gravel if available at site for other purposes. If pea-gravel is unavailable, native soil may be used for backfill if all the following conditions are met.
1. All broken concrete and sharp stones (+1” dia.) to be removed from backfill soil.
2. All large stones (3’ dia. or bigger) to be removed from backfill soil.
3. Piping shall be bedded on min. 2” thickness of replaced “rock free” soil and then checked for grade.

E. Establish elevations of buried piping with not less than 3 ft of cover.

F. Establish minimum separation from other services piping in accordance with Code.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install plastic ribbon tape continuous over top of pipe.

J. Install trace wire continuous over top of pipe.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Install piping on interior side of building insulation.

E. Provide heat tape for all piping in unheated areas.

F. Sleeve pipe passing through partitions, walls and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

J. Grooved Joints: Install in accordance with the manufacturer's (Victaulic) guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

K. Provide access panel where valves and fittings are not accessible.

L. Install non-conducting dielectric connections wherever jointing dissimilar metals.

M. Slope piping and arrange systems to drain at low points. Provide hose bibb if low point is not at a plumbing fixture.

N. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

O. Insulate piping. Refer to Section 22 07 00.

P. Install pipe identification in accordance with Section 22 05 00.

## 3.4 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

B. Grade piping to drain at low points. Provide hose bibb if low point is not at plumbing fixture.

C. Install water piping on interior side of building insulation. Provide heat tape for all piping in unheated areas.

D. Provide water hammer arrestors at appliances/fixtures with quick closing valves.

3.5 VALVES

A. Use ball valves for up to 4” piping.

B. Gate valves which are part of a valve assembly are acceptable.

3.6 INSTALLATION - THERMOMETERS AND GAUGES

A. Install pressure gauges on each side of domestic water service assembly (i.e double check, PRV, etc.).

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.7 FIELD QUALITY CONTROL

A. Test domestic water piping system at 100 psig minimum for a period of not less than 4 hours.

3.8 CLEANING

A. Flush system with water for minimum of 60 minutes to remove all dirt and foreign materials. Use minimum of 80 psi flushing pressure.

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

C. Bleed water from outlets to obtain distribution and test for disinfectant residual at a minimum of 15 percent of outlets.

D. Maintain disinfectant in system for 24 hours.

E. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

END OF SECTION

SECTION 221300

FACILITY SANITARY SEWERAGE

PART 1 PRODUCTS

1.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe & Fittings: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
1. Fittings: ASME B16.45 or ASSE 1043, long pattern cast iron, hubless.
2. Joints: Heavy-Duty, Shielded, Stainless-Steel coupling with all type 304 stainless steel shield and band assembly, 80 in/lbs worm drive. ASTM C-564 Neoprene gasket. CISPI 310 and certified by NSF international. Minimum 4 clamps up to 4”, 6 clamps for 5” and larger. Husky SD (Super-Duty) 4000, Clamp-All 125, Ideal Tridon Super Heavy-Duty or approved equal.

B. ABS Pipe: Schedule 40, ABS material, DWV, Cellular Core, bell and spigot style solvent sealed ends. NSF Standard 14, ASTM F628, ASTM D3965.
1. Fittings: ABS, DWV, ASTM D2661.
2. Joints: Solvent weld. ASTM D2235.

C. PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends. NSF Standard 14, ASTM D1785, ASTM D1784.
1. Fittings: Schedule 40, PVC, ASTM D2665.
2. Joints: Solvent weld with ASTM D2564 solvent cement.

1.2 SANITARY SEWER PIPING, ABOVE GRADE

A. ABS Pipe: Schedule 40, ABS, DWV, Cellular Core, bell and spigot style solvent sealed ends (If approved by local authorities). NSF Standard 14, ASTM F628, ASTM D3965.
1. Fittings: ABS, DWV, ASTM D2661.
2. Joints: Solvent weld. ASTM D2235.

B. PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends (If approved by local authorities). NSF Standard 14, ASTM D1785, ASTM D1784.
1. Fittings: Schedule 40, PVC, ASTM D2665.
2. Joints: Solvent weld with ASTM D2564 solvent cement.

C. **[VENT]** ABS Pipe: Schedule 40, ABS, DWV, Cellular Core, bell and spigot style solvent sealed ends (If approved by local authorities). NSF Standard 14, ASTM F628, ASTM D3965. **Not for use in air plenum.**
1. Fittings: ABS, DWV, ASTM D2661.
2. Joints: Solvent weld. ASTM D2235.

D. **[VENT]** PVC Pipe: Schedule 40 solid wall PVC, bell and spigot solvent sealed ends (If approved by local authorities). NSF Standard 14, ASTM D1785, ASTM D1784. **Not for use in air plenum.**
   1. Fittings: Schedule 40, PVC, ASTM D2665.
   2. Joints: Solvent weld with ASTM D2564 solvent cement.

**ADD ALTERNATE: Provide Cast Iron for all above grade waste piping.**

A. Cast Iron Pipe & Fittings: ASTM A888, CISPI 301, hub-less. Made in USA by AB&I, Charlotte or Tyler marked with collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
   1. Fittings: ASME B16.45 or ASSE 1043, long pattern cast iron, hubless.
   2. Joints: Standard-Duty, Shielded, Stainless-Steel coupling with all type 304 stainless steel shield and band assembly. ASTM C-564 Neoprene gasket. CISPI 310 and certified by NSF international. Husky HD 2000, Clamp-All 80, Mission Heavyweight, Ideal Tridon Heavy-Duty “HD” Yellow or approved equal.

1.3 NO-HUB TRANSITION COUPLING FOR JOINING CAST IRON AND PVC PIPE

A. Coupling shall be Tested and Certified to ASTM C 1460 and be constructed with type 304 stainless steel shield, thickness 0.015, gasket material to meet ASTM C564, 1-1/2" - 4" will be 3" wide with four (4) 304 stainless steel bands and 6" - 10" will be 4" wide with six (6) 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds. Husky SD 4000 PVC x CI or approved equal.

1.4 EQUIPMENT DRAINS (CONDENSATE)

A. Copper Tubing: Type L, hard drawn. ASTM B88.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

B. CPVC Pipe: Schedule 40. ASTM D2846. **Not for use in air plenum.**
   1. Fittings: Schedule 40 CPVC. ASTM D2846.
   2. Joints: Solvent weld with ASTM F493 solvent cement. ASTM D2846.

1.5 FLOOR DRAINS

A. Manufacturers: Zurn, Josam, J.R. Smith, Wade, Sioux Chief or approved equal.

B. General Service: Cast iron body, membrane clamp, adjustable collar, polished nickel bronze strainer, trap primer connection. Provide funnel where scheduled.

1.6 CLEANOUTS

A. Manufacturers: Zurn, J.R. Smith, Josam, Wade or approved equal.

B. Exterior or interior vehicle areas: Heavy-Duty round coated cast iron body and cover with bronze plug.

C. Exterior Surfaced Areas: Round cast nickel bronze access frame with bronze gasket threaded plug and non-skid cover.

D. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and bronze gasket threaded plug.

E. Interior Finished Floor Areas: Type of ferrule, top and cover as required for the type of floor construction, finish surface and traffic conditions. Cleanout construction material to match waste piping with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas. For carpet provide marker. For cast iron construction provide bronze gasket threaded plug.

F. Interior Finished Wall Areas: Cleanout construction material to match waste piping, line type with round gasket threaded plug, and round stainless steel access cover secured with machine screw. For cast iron construction provide bronze gasket threaded plug.

G. Interior Unfinished Accessible Areas: Threaded type. Provide bolted stack cleanouts on vertical waste stacks.

1.7 BACKWATER VALVES

A. Manufacturers: Clean Check or approved equal.

B. Check: PVC tee-shaped valve body, top collar with stainless steel thumb screw and bottom collar with PVC flapper. Contractor to provide PVC access riser. Provide metal access at grade where installed in drive isle or sidewalk, Olympic Foundry or equal.

1.8 FLASHING AND COUNTERFLASHING

A. 3lb. lead soldered joints and seams, 24 x 24 base pad and counterflashed into pipe.

1.9 TRAP PRIMER

A. Manufacturers: PPP, Wade, J.R. Smith, Josam, Watts, Zurn or approved equal.

B. Construction: Automatic, bronze body, integral vacuum breaker.

C. See 221100 for trap primer piping.

1.10 TRAP PRIMER TAIL PIECE

A. Manufacturers: PPP or approved equal.

B. Construction: 1-1/2" tail piece trap primer assembly with ½" stainless steel flexible priming water line and chrome plated escutcheon.

C. See 221100 for trap primer piping.

## PART 2 EXECUTION

### 2.1 PREPARATION

A. Remove scale and dirt, on inside and outside, before assembly.

B. Prepare piping connections to equipment with flanges or unions.

C. Verify and provide required extensions, clamps and drain styles to match floor construction and finish.

### 2.2 INSTALLATION

A. Coordinate location of floor drains in mechanical spaces with mechanical contractor equipment layout.

B. Protect floor drain strainer during construction.

C. TRAPS:
1. Install trap seal maintenance devices only where called for on plans or approved by engineer; at all other drain locations provide automatic trap primers.
2. Install automatic trap primers throughout at site drains and floor drains except those located in showers or provided with trap seal maintenance devices.
3. Provide access panels for automatic trap primers.
4. Adjust automatic trap primer pressure setting for proper operation.

D. Align square floor drains with floor tiles or parallel with walls.

### 2.3 CONDENSATE PIPING

A. Provide condensate piping for air-conditioning and high-efficiency gas fired equipment. Coordinate quantity required with mechanical contractor. Provide minimum 3" deep p-trap at equipment.

B. Determine best routing to nearest indirect waste using minimum 3/4" piping with minimum 1/8" per foot slope. Acceptable indirect waste locations are service sink, laundry sink, floor drain or air gap fitting into waste pipe. Provide open drain box or access panel for air gap fitting as approved by local authority. Discharge onto roof or at grade is acceptable if allowed by local code, provide splash block.

C. If proper slope cannot be achieved advise Mechanical Contractor to provide condensate pump.

2.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

B. Provide connections to site mains as indicated on drawings.

C. Grade piping at 1/4” per foot where possible, but in no case less than 1/8” per foot. Install all main vertical soil and waste stacks with provisions for expansion and extend full size to roof line as vents.

D. Install buried ABS piping per ASTM D2321 and ASTM F1668.

E. Backfill trenching with pea-gravel if available at site for other purposes. If pea-gravel is unavailable, native soil may be used for backfill if all the following conditions are met.
1. All broken concrete and sharp stones (+1” dia.) to be removed from backfill soil.
2. All large stones (3’ dia. or bigger) to be removed from backfill soil.
3. Piping shall be bedded on min. 2” thickness of replaced “rock free” soil and then checked for grade.

F. Establish elevations of buried piping with not less than 3 ft of cover.

G. Establish minimum separation from other services piping in accordance with Code.

H. Provide piping layout to satisfy the UPC requirements for suds relief.

I. Route pipe in straight line.

J. Install pipe to allow for expansion and contraction without stressing pipe or joints.

K. Install plastic ribbon tape continuous over top of pipe.

L. Install trace wire continuous over top of pipe.

2.5 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient at 1/4” per foot where possible, but in no case less than 1/8” per foot. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Install piping on interior side of building insulation.

E. Provide heat tape for all p-traps in unheated areas.

F. Sleeve pipe passing through partitions, walls and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Protection: Where piping, other than cast iron or steel, is installed in a concealed location through holes or notches in framing (i.e. studs, joists, rafters, etc.), less than 1-1/2 from framing edge, provide shield plates. Shield plates shall be 16 gauge steel and cover the piping area within framing plus 2” on each side along framing.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access panel where valves and fittings are not accessible.

K. Install non-conducting dielectric connections wherever jointing dissimilar metals.

L. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Provide 1/8 inch per foot only where necessary and allowed by local jurisdiction. Maintain gradients.

M. Provide piping layout to satisfy the UPC requirements for suds relief.

N. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

O. Install piping penetrating roofed areas to maintain integrity of roof assembly.

P. Insulate piping. Refer to Section 22 07 00.

Q. Install pipe identification in accordance with Section 22 05 00.

2.6 INSTALLATION - SANITARY WASTE AND VENT SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9 and local plumbing code.

B. Support cast iron drainage piping at every joint.

C. Flash and counterflash. Install vents passing through roof with roof flashing and counterflashing assemblies. 3lb. lead soldered joints and seams, 24 x 24 base pad and counterflashed into pipe.

D. Install automatic trap primers throughout at floor drains except those located in showers. Provide access panel for trap primers.

E. Provide piping layout to satisfy the UPC requirements for suds relief.

F. Provide cleanouts every 50 feet and install at all locations required by code and to permit cleaning of all waste piping. Provide cleanouts full size of pipe, but no larger than 4”. Coordinate with Architect when cleanouts are located in finished

rooms. Install cleanout threads with graphite. Locate cleanouts to clear cabinet work and to be easily accessible.

2.7 INSTALLATION – BACKWATER VALVES

A. Label all cleanouts upstream of a backwater valve with a permanent label which reads “Backwater Valve Downstream”.

2.8 FIELD QUALITY CONTROL

A. Obtain written approval of local Plumbing Authority prior to covering or concealing any work.
B. Test sanitary waste and vent piping system to hydrostatic test of 10 feet head of water.

END OF SECTION

# SECTION 223000

# PLUMBING EQUIPMENT

## PART 1 GENERAL

### 1.1 SCOPE

A. Provide plastic venting and combustion air for water heaters and boilers in this section.

### 1.2 COORDINATION

A. For equipment which requires metal venting coordinate required material and location with Division 23.

### 1.3 QUALITY ASSURANCE

A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by Washington State Residential Energy Code and **R406 Credit 5.5** and as scheduled on drawings.

## PART 2 PRODUCTS

### 2.1 RESIDENTIAL ELECTRIC HEAT PUMP WATER HEATER

A. Manufacturers: Rheem or approved equal.

B. Type: Hybrid-electric, vertical storage. Minimum EF = 3.0

C. Tank: Glass lined welded steel, minimum 2-1/2" thermal insulation, encased in corrosion-resistant steel jacket with baked-on enamel finish. Minimum energy factor 3.0, minimum 5 year warranty.

D. Controls: UL 174, automatic water thermostat with temperature range from 120 to 170 degrees F, flanged or screw-in copper or incoloy steel elements, enclosed controls and electrical junction box. Wire double element units so elements do not operate simultaneously.

E. Accessories: Brass water connections and dip tube, drain valve, aluminum/stainless steel or magnesium anode and ASME temperature and pressure relief valve. Provide with ducted kit.

### 2.2 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers: Amtrol, Armstrong or approved equal.

B. Construction: Welded steel, pre-charged flexible EPDM diaphragm sealed into tank; steel ring base (vertical) or saddles (horizontal)

C. Accessories: Pressure gauge and air-charging fitting, tank drain.

D. Installation: Before installation, charge tank with Nitrogen gas to equal domestic water line pressure at tank. Permanently mark fill pressure on tank.

## PART 3 EXECUTION

### 3.1 INSTALLATION – WATER HEATER

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. For electric water heaters include incompressible insulated surface (R-10 min).

C. Anchor or strap to structure to resist horizontal displacement due to earthquake. IAPMO listed, galvanized steel, double body straps, Hubbard Quick Strap or approved equal.

D. Connect domestic hot water and domestic cold water piping to water heater connections.

E. Install the following piping accessories. Refer to Section 22 11 00.
   1. On cold water:
      a. Thermometer well and thermometer.
      b. Shutoff ball valve.

   2. On hot water:
      a. Thermometer well and thermometer.
      b. Shutoff ball valve.

F. Install discharge piping from relief valves and drain valves to nearest floor drain or indirect waste location. Determine best routing.

G. Provide pan where required or specified.

H. Install water heater trim and accessories furnished loose for field mounting.

I. Install electrical devices furnished loose for field mounting.

J. Install control wiring between water heater control panel and field mounted control devices.

END OF SECTION

# SECTION 224000

# PLUMBING FIXTURES

## PART 1 GENERAL

### 1.1 SCOPE

A. This section includes all plumbing fixtures, trim and installation, to include owner furnished equipment.

### 1.2 REQUIREMENTS

A. All china fixtures shall be white or manufacturer's standard unless otherwise indicated.

B. Ensure that all china fixtures install in a room or area are the exact same color and hue, especially if from different manufacturers.

C. Fixtures by type and material shall be of the same manufacturer except when scheduled or approved otherwise.

D. Tank type water closets shall have a minimum MaP (Maximum Performance) of 500 g.

E. Fixtures shall be designed or equipped to meet the 2018 Uniform Plumbing Code and Evergreen Sustainable Development Standard (ESDS) version 4.0 water use efficiency standards.

## PART 2 PRODUCTS

### 2.1 TANK TYPE WATER CLOSETS

A. Manufacturers: Toto, Niagara, Mansfield or approved equal

B. Gravity: white, vitreous china, floor mount, 12" rough-in, 15" rim height, gravity feed flush with 3" valve, elongated bowl, close-coupled closet combination, insulated vitreous china closet tank with fittings and lever flushing valve, siphon jet, 2-1/8" passageway, chrome plated bolt caps.

C. Gravity (ADA): white, vitreous china, floor mount, 12" rough-in, 16-1/2" rim height, ADA compliant, gravity feed flush with 3" valve, elongated bowl, close-coupled closet combination, insulated vitreous china closet tank with fittings and lever flushing valve, siphon jet, 2-1/8" passageway, chrome plated bolt caps.

### 2.2 WATER CLOSET SEATS

A. Manufacturers: Bemis, Olsonite or approved equal.

B. Open Front: Heavy duty solid plastic, white, large molded-in bumpers, external check hinges with stainless steel posts, without cover.

C. Closed Front: Heavy duty solid plastic, white, large molded-in bumpers, external check hinges with stainless steel posts, with cover.

2.3 LAVATORIES

A. Manufacturers: Kohler, Eljer, Crane, American Standard or approved equal.

B. Counter Top: white, vitreous china, self-rimming, overflow, ADA compliant.

2.4 SINKS

A. Manufacturers: Elkay, Just, Acorn, Silvercast or approved equal.

B. Single Compartment: Seamless 18 gauge. Type 304 stainless steel, self-rimming, radius corners, sound deadening undercoat.

2.5 BATHTUBS

A. Manufacturers: Kohler, Eljer, American Standard or approved equal.

B. White, porcelain enameled steel, acid resistant, recessed with integral apron and tiling flange, slip-resistant coating. Verify left or right hand outlet.

2.6 FAUCET, LAVATORY

A. Manufacturers: Moen, Chicago, Geberit, Delta HDF, Symmons or approved equal and as specifically noted below.

B. Centerset:
1. Single Handle: Polished chrome plated cast brass, deck mount, metal lever handle, ceramic mixing cartridge, temperature limit stop, 1.0 gpm aerator. Spout length, drain and hole spacing as scheduled.

2.7 FAUCET, SINK

A. Manufacturers: Moen, Chicago, Delta HDF, Symmons or approved equal.

B. Swing Spout:
1. Single Handle: Polished chrome plated cast brass, deck mount, metal lever handle, ceramic mixing cartridge, temperature limit stop. Spout length, drain and hole spacing as scheduled.

2.8 SHOWER/TUB VALVES

A. Manufacturers: Moen, Chicago, Delta HDF, Symmons or approved equal and as specifically noted below.

B. Shower/Tub: Pressure balancing valve that cycles from cold to hot, lever handle, diverter tub spout, chrome plated brass, integral service stops, complete with shower head, arm and flange.

2.9 SHOWER HEADS

A. Manufacturers: Moen, Speakman or approved equal.

B. Solid brass construction, polished chrome finish, 6-jet showerhead, infinitely adjustable spray streams with operating handle, pressure-compensating auto-flow limit to 1.5 gpm.

2.10 SHOWER HAND SPRAY

A. Manufacturers: Moen, Alsons or approved equal.

B. Personal handheld shower with push button, on-off control, 60” double spiral metal hose, 36” stainless steel slide/grab bar, ADA adjustable slide, chrome plated vacuum breaker, chrome plated wall supply elbow.

2.11 HOSE BIBBS

A. Manufacturers: Prier, Woodford, Zurn, JR Smith or approved equal.

B. Exterior (Freeze Proof): Automatic draining, freezeless, hose connection backflow protection, two check valves, 3/4” hose thread, loose key handle, wall clamp.

2.12 FIXTURE SUPPLIES

A. Manufacturers: Brass Craft, McGuire or approved equal.

B. Chrome plated all brass angle stops with brass stems (no plastic). Fixed key metal handle and chrome plated escutcheon. Chrome plated copper flexible supplies for exposed connections, braided supplies acceptable where concealed. Provide stop and supply type as applicable to specific fixtures. Supply shall be marked with manufacturer’s name and comply with ANSI NSF 61 “No Lead”.

2.13 TRAPS

A. Manufacturers: Brass Craft, Dearborn Brass, McGuire or approved equal.

B. Adjustable type, polished chrome plated cast brass, 17 gauge, with escutcheon. Provide type as applicable to specific fixture installation. PVC acceptable only where concealed.

2.14 LAVATORY INSULATION KIT

A. Manufacturers: Truebro, Plumberex, McGuire or approved equal.

B. Where lavatories or sinks have exposed traps or supplies furnish the following for ADA compliance: Safety Covers conforming to ANSI A177.1 and consisting of

insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers, antimicrobial, with flush reusable fasteners.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify electric power is available and of correct characteristics.

C. For all lavatories and sinks verify required number of holes and hole spacing before ordering.

### 3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures and in accordance with manufacturer's details.

B. Locate fixtures in accordance with architectural drawings, details on structural drawings and/or Engineer's direction in field. Mount ADA fixtures according to dimensions on architectural drawings.

C. If drain, tailpiece, strainer or other accessories are not furnished by fixture manufacturer then provide accessories by Brass Craft or approved equal.

D. Provide vandal proof features on faucets, aerators, bubblers and pop-up waste assemblies on fixtures in public areas.

### 3.3 INSTALLATION

A. Support piping at stop, valve or flush valve.

B. Align fixtures and equipment installed in accord with architectural drawings.

C. Locate shower head mounting height 80” minimum from drain to centerline of head pipe.

D. Locate shower curtain rod minimum 6’-3” AFF (verify with architect).

E. Locate water recessed valve boxes for refrigerators at 18” AFF.

F. Seal fixtures to wall and floor surfaces with silicon sealant, color to match fixture.

G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and ordering.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. Adjust flush lever or valve for intended flow rate and operation.

END OF SECTION

SECTION 23 00 00

HVAC GENERAL CONDITIONS

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.2 SUMMARY

A. Design Intent: Provide HVAC for a 12-unit three story residential project.

B. Provide labor, materials and appliances necessary for satisfactory installation of mechanical work ready to operate in strict accordance with these specifications and drawings. Work of Division 23 includes, but is not limited to, that as delineated in the following specification sections:

23 00 00 HVAC General Conditions

23 05 00 Common Work Results for HVAC

23 05 93 Testing, Adjusting and Balancing

23 07 00 HVAC Insulation

23 31 00 HVAC Ducts and Casings

23 37 00 Air Outlets and Inlets

23 72 00 Energy Recovery Units

C. Related Sections:
019113General Commissioning Requirements

1.3 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over mechanical installation.
1. Uniform Plumbing Code (UPC) with local amendments.
2. 2018 International Mechanical Code (IMC) with local amendments.
3. 2018 International Residential Code (IRC) with local amendments.
4. International Fuel Gas Code (IFGC) with local amendments.
5. 2020 National Electrical Code (NEC) NFPA 70.
6. Requirements of OSHA and EPA.
7. National Fire Protection Association (NFPA) Codes and Standards.
8. ASME code for construction of pressure vessels.
9. American Gas Association (AGA) Standards.

10. ASTM, ANSI and NEMA standards, as referenced in subsequent sections.
11. Local Sewer District Requirements.
12. Local Water District Requirements.
13. Local Health Department Requirements.
14. 2018 Washington State Residential Energy Code (WSREC).
15. Evergreen Sustainable Design Standard (ESDS) version 4.0.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Residential Code with local amendments, and UL for fire resistance ratings and surface burning characteristics.

B. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.

C. Provide minimum static deflection of isolators for equipment as follows for 5 hp and less: 1 inch

D. Maintain rooms below the maximum sound levels, as defined by ASHRAE Handbook *HVAC Applications* and ANSI S1.8.

1.5 PRODUCT SUBSTITUTIONS

A. Manufacturers and models of equipment and material indicated herein and on drawings are those upon which mechanical design is based. Other manufacturers with products considered equal in general quality may be listed without specific model designation. Manufacturers not listed shall be submitted for approval, see Division 01.

B. Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

C. Any equipment other than the basis of design is considered a substitution.

D. In selecting substitute equipment, the Contractor is responsible for and shall guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Unless indicated otherwise, “or approved” may be assumed for all products in Division 23.

1.6 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Division 23 and all additional products noted on drawings or required for completion of sequence of operations.

B. Electronic: **Submittals shall be complete in one PDF file with bookmarks for each Division. Multi-part submittals will be returned without review.**
   1. First Page: Name of Project, Owner, Location & Contracting Company.
   2. Index Page: List of specification sections with contents by Tag or item.
   3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

C. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

D. Equipment vendor cover page with contact information shall precede submittal by that vendor.

E. Submitted product information shall include (as applicable) but not be limited to the following information:
   1. Product description
   2. Manufacturer and model
   3. Dimensions
   4. Performance Ratings (i.e. capacity, rpm, HP, temperature)
   5. Construction Materials
   6. Ratings (i.e. UL, ASTM, NEMA, etc)
   7. Electrical data
   8. Sound level data (corresponding to scheduled values)
   9. Vibration Isolation
   10. Controls and wiring diagrams
   11. Accessories
   12. Engineering technical data (i.e. pressure drops, leakage rates, pump curves, fan curves)

F. If requested by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

G. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

1.7 COMMISSIONING

A. See Division 01 and Contract Drawings for roles and responsibilities of commissioning.

B. Provide all necessary commissioning assistance, equipment and documentation as required by the Commissioning Plan.

C. The duty and responsibility for mechanical commissioning work shall be assigned to a specific individual. Inform the General Contractor and Certified Commissioning Professional (CCXP) of the contact information for the person so assigned.

D. Perform corrective actions needed to resolve deficiencies identified during commissioning. Record action taken on commissioning deficiency log.

1.8 HVAC PERMIT

A. HVAC contractor shall prepare all documents for mechanical permit application, submit for, and obtain the permit. HVAC Contractor shall pay all costs and fees to obtain the permit.

B. Contractor shall not commence work until permit is obtained. Contractor is solely responsible to insure that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

C. Permit documents may include (but are not limited to) the following:
1. Mechanical cover sheet (Contractor shall prepare this sheet. Architect will assist the contractor and provide the required non-mechanical information).
2. Mechanical Load Calculations (Mechanical Consultant will provide load calculations to the Contractor).
3. Acoustical Reports. Mechanical Contractor shall obtain the required acoustical reports from the acoustical engineer for the project.
4. Energy Compliance Forms.

D. Where necessary, Contractor shall retain services of a third party structural engineer to provide support, anchoring and seismic calculations for all applicable equipment.

1.9 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 – Building Services Piping for installation of piping systems and ASME Section IX – Welding and Brazing Qualifications for welding materials and procedures.

B. Perform Work in accordance with the International Mechanical Code including State and local amendments.

C. Provide products requiring electrical connections listed and classified by UL as suitable for purpose specified and indicated.

D. Perform Work in accordance with Washington State Energy Code.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect all equipment, materials, and insulation from weather, construction traffic, dirt, water, chemicals, and damage by storing in original packaging and under cover. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

C. Inspect all products and materials for damage prior to installation.

D. Protect piping from all entry of foreign materials by providing temporary end caps or closures on piping and fittings. Furnish temporary protective coating on cast iron and steel valves.

E. Protect dampers from damage to operating linkages and blades.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

H. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

I. Comply with contractor’s construction Indoor Air Quality (IAQ) Plan.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Provide ventilation in areas to receive solvent cured materials.

C. Do not install underground piping, tanks, or tank foundations when bedding is wet or frozen.

D. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer. Maintain temperature during and after installation for minimum period of 24 hours.

E. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

F. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers. Maintain temperatures during and after installation of duct sealant.

G. Do not install condensing unit foundation pad when ground is frozen or muddy.

1.13 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify by field measurements, sizes and configurations are compatible with wall construction and layout.

1.14 COORDINATION

A. Visit the site and become familiar with existing conditions affecting work.

B. Verify locations of any overhead or buried utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. HVAC drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments to piping or ductwork as necessary to fit conditions including but is not limited to relocation, offsets, and transitions.

D. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

E. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

F. Prior to ordering equipment cross-check mechanical and electrical drawings and specifications to assure proper location and electrical characteristics of connections serving mechanical and electrical equipment.

G. Advise the Architect of any modifications required to suit equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

H. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

I. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or equipment roughed in improperly and not positioned on implied centerlines or as required by good practice shall be repositioned at no cost to the Owner.

J. Where the word ‘verify’ is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

K. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

L. Coordinate wall openings, piping rough-in locations, concrete housekeeping pads, and electrical rough-in locations to accommodate Work of this Section.

M. Coordinate all equipment with building control work.

N. Coordinate installation of
1. Condensing units with concrete pad and roof structure.
2. Air handling units with building structure.
3. Unit installation with roof structure, piping systems, and ceiling for unit access.

1.15 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, where possible, by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

1.16 SALVAGE

A. Remove excess piping and ductwork, plug or cap any unused branch connections. Remove scrap pipe and all other excess materials from the site.

B. Comply with contractor’s Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

1.17 ELECTRICAL

A. Short-Circuit Current Rating (SCCR): All HVAC and refrigeration equipment with multi-motor or combination electrical loads shall comply with NEC 110.10 & 440.4 and must include a SCCR greater than the Available Interrupting Current (AIC) of the electrical circuit serving the equipment. See electrical drawings for required AIC kA rating. Equipment SCCR may be presented in writing from the manufacturer or shown on the unit nameplate. Refrigeration or air-conditioning equipment over 60 Amps MOCP must list the SCCR on the unit nameplate. If the AIC rating is unavailable or cannot be determined provide equipment with a minimum SCCR of 10kA.

B. Motors:
   1. Temperature Rating: Rated for 40 degree C environment with maximum 50 degree C temperature rise for continuous duty at full load.
   2. Starting Capability: Not less than 12 starts per hour.
   3. Phase Characteristics: Squirrel-cage induction poly-phase motors for 3/4 HP and larger, and capacitor-start single-phase motors for 1/2 HP and smaller. At equipment manufacturer's option, 1/6 HP and smaller may be split-phase type.
   4. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
   5. Enclosure Type: Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and guarded drip-proof motors where exposed to contact by employees or building occupants. Weather-protected Type I for outdoor use, Type II, where not housed.
   6. Overload Protection: Built-in thermal overload protection.
   7. Name Plate: Indicate full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
   8. All motor efficiencies shall conform to Washington State Energy Code and NEMA MG-1.

C. Motor Starters: By mechanical equipment manufacturer where factory mounted controls are provided. Variable frequency drives by Division 23, all other starters provided by Electrical Contractor.

D. Power Wiring: By Electrical Contractor.

E. Control Wiring: Responsibility of Division 23, including all line and low voltage control wiring. Owner will not entertain additional cost due to lack of coordination between HVAC Contractor and Electrical Contractor.

1.18 EXTRA MATERIALS

A. Furnish one spare set of disposable filters for each air handling unit.

1.19 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout.
   1. Execution of Architect's and Engineer’s final observation reports (punchlist)
   2. Operating and Maintenance Instructions
   3. Operating and Maintenance Manual
   4. Equipment and Pipe Cleaning
   5. Record Drawings
   6. Testing
   7. Commissioning
   8. Warranty

B. See Division 01 for additional requirements.

1.20 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: In addition to requirements of Division 01, following initial operation of HVAC systems and prior to acceptance by the Architect, perform the following services.

B. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.

C. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, setpoint adjustment, safeties and alarms.

D. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
   1. Provide documentation of all instruction which includes:
      a. Date and time of instruction
      b. Name and affiliation of the instructor
      c. Name and affiliation of the attendees
      d. Topics, systems, and equipment covered
      e. Length of instruction

E. Minimum duration of instruction periods:
   1. HVAC/Control Systems 2 hours

1.21 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, one PDF and one bound copy of operating and maintenance manuals to include the following:
   1. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   2. Warranty service contractors' names, address and phone numbers (if different from above).
   3. Schedule and description of routine maintenance for each component to include oiling, lubrication and greasing data.
   4. Manufacturer's cuts and rating tables, including brochures for all submittal items.
   5. Part numbers of all replaceable items.
   6. Control diagrams and operation sequence.
   7. Written guarantees.
   8. Record drawings corrected and completed.
   9. Completed equipment start-up forms and checklists.
   10. Final copy of testing, adjusting, and balancing report.

B. Operation and Maintenance Data:
   1. Include, spare parts lists, exploded assembly views for all equipment.
   2. Submit installation instructions, adjustment instructions, spare parts lists, exploded assembly views for all equipment.

3. Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
4. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data. Include directions for resetting constant volume regulators.

C. Filters: Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

D. Binders:
1. Furnish typewritten or printed index and tabbed dividers between principal categories.
2. Bind each manual in a hard-backed loose-leaf binder.

E. Imprint on cover:
1. Name of project.
2. Owner.
3. Location of project.
4. Architect.
5. Contractor.
6. Year of completion.

F. Imprint on backing:
1. Name of project.
2. Year of completion.

G. Submittals:
1. Preliminary Copies: Prior to scheduled completion of the project, submit one PDF copy for review by the Architect.
2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

1.22 EQUIPMENT AND PIPE CLEANING

A. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

B. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of pipe, ductwork and equipment. Any collection of material shall be thoroughly cleaned before equipment startup and if necessary again before owner occupancy.

C. Clean exterior of all exposed pipe and ductwork.

1.23 RECORD DRAWINGS

A. Submit one digital file with all drawings in PDF format.

B. Make all notes and revisions on PDF set in red.

C. Show location of equipment, location and size of piping, location and size of ductwork. Locate all valves, control dampers and similar equipment with tag or label identification. Indicate locations and elevations of exterior pipe and utility connections. Maintain continuously updated drawings during progress of project.

D. Record actual locations of tagged valves and control dampers; include valve tag numbers. Record actual locations of flexible connectors and expansion joints.

E. Record actual locations of equipment, clean-outs, controlling devices, and all above grade, under-floor, and buried piping and ductwork. Provide dimensions from gridline or walls to indicate specific locations.

1.24 TESTING

A. Provide completed start-up forms and checklists.

B. Perform testing and balancing of HVAC systems as described in this Division and as required by applicable codes and ordinances.

C. Provide changes in sheaves, belts, and dampers as required for correct balance.

D. Support the third-party commissioning work for the building, including providing startup sheets and assistance for Commissioning Agent.

1.25 WARRANTIES AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. Furnish one year warranty from date of substantial completion for all systems unless specifically noted otherwise.

C. Without cost to Owner, **correct all defects and failures discovered within one year from date of final acceptance**, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.

D. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

E. Make all necessary balancing and control adjustments during first year of operation.

F. The presence of any inspector or observer during any construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. Engineer will revise and/or prepare drawings for submittal.

3.2 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition.

3.3 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation for proper movement clearance.

3.4 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean ductwork and equipment.

3.5 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.2 GENERAL REQUIREMENTS

A. Comply with requirements and recommendations of Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58 and SP-69.

B. Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

C. Conform to requirements of IBC 1613 and SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems".

1.3 MATERIALS AND EQUIPMENT

A. Where two or more units of same class of equipment are required, use products of a single manufacturer. All equipment shall be new and free from damage.

B. Protect stored material and equipment against weather, corrosion and dirt. Protect installed mechanical components, including but not limited to piping, ductwork, and equipment against weather damage, corrosion, dirt and construction dust. Seal equipment and ductwork where and when necessary to be kept clean.

C. Provide major equipment components with manufacturer's name, address, catalog number and capacity indicated on a nameplate, securely affixed in a conspicuous place.

D. Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

1.4 REQUIREMENTS

A. Provide incompressible inserts and shields at all piping supports on pipe to be insulated per 23 07 00.

B. Provide vibration isolation on motor driven equipment, plus connected piping.

C. Firestopping Materials: Provide to achieve fire ratings as noted on architect's drawings for adjacent construction, but not less than 1 hour fire rating. ASTM and UL.
   1. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/50.
   2. Firestop interruptions to fire rated assemblies, materials, and components.

D. Prevent contact between dissimilar metals, such as copper tubing and steel, by use of copper-plated, plastic coated, or flexible materials. All supports which contact copper tubing shall be copper plated.

1.5 QUALITY ASSURANCE

A. Installed products shall have surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Perform work in accordance with local jurisdiction's requirements and AWS D1.1 for welding hanger and support attachments to building structure.

C. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.1 DUCT HANGERS AND SUPPORTS

A. Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

B. Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

C. Provide galvanized steel band or fabricated angle iron brackets for wall supports.

D. Exposed ducts shall be supported/anchored to structure at closer spacing and using heavier materials, wherever so indicated on drawings.

E. Hanger Rods: Carbon Steel, with hex nuts and flat washers.

F. Beam Clamps and Attachments as required.

2.2 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports with incompressible insulation inserts and shields for all piping to be insulated per 230700.

2.3 HANGER ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 PIPE SUPPORT AT GRADE

A. Refer to details on drawings for supports and piping protection.

2.5 ACCESS PANELS

A. Milcor or approved equal.

B. Include an allowance for a minimum of 2 access panels per unit.

C. Architectural grade, 14 gauge frame and door, painted steel or stainless steel based on application.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, 300 psi CWP, malleable iron, threaded.
2. Copper Piping: Class 150, 300 psi CWP, bronze unions.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. PVC Piping: PVC.
5. CPVC Piping: CPVC.

B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or Schedule 80 threaded PVC pipe (ASTM D2464).

2.7 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.8 EQUIPMENT CURBS

A. Manufacturers' curbs where indicated on drawings.

2.9 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Ductwork: 18 gage thick galvanized steel.

D. Sealant: Acrylic

E. Size large enough to allow for movement due to expansion and to provide for continuous insulation or installation of fire sealant at fire-rated walls. Note that insulation is discontinuous at fire walls.

2.10 FORMED STEEL CHANNEL

A. Manufacturers: Allied Tube & Conduit, B-Line Systems, Unistrut or approved equal.

B. Product Description: Galvanized 12 gage thick steel, with holes 1-1/2 inches on center.

2.11 FIRESTOPPING-APPLIED

A. Manufacturers: RectorSeal, Dow Corning, 3M Fire Protection or approved equal.

B. General:
1. Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by applicable building codes and tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests for through penetrations, and ASTM E 1966 or UL 2079 for construction joints, and UL 2307 for perimeter edge joints.
2. Fire stopping material shall be free of asbestos, PCBs, ethylene glycol, and lead.
3. Do not use any product containing solvents or that requires hazardous waste disposal.
4. Fire stopping shall be performed by a contractor trained or approved by firestop manufacturer.
5. Select products with rating not less than rating of wall or floor being penetrated.

C. Single Source Responsibility: Provide firestop systems for all conditions from a single supplier.

D. Product Description: Provide Latex caulk/sealant, Silicone caulk/sealant, Intumescent Wrap Strip, Firestop Putty, Firestop Collar or Intumescent Sleeve to meet each specific application and performance requirement.

E. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

F. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
1. Forming/Damming Materials: Mineral fiberboard, backer rod or other type recommended by Manufacturer’s tested system.

2.12 PENETRATIONS OF NON-RATED SURFACES

A. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

B. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.13 VIBRATION ISOLATORS

A. Manufacturers: Metraflex, Mason, Amber Booth or approved equal.

B. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
   a. 30 durometer.
   b. Minimum 1/2 inch thick.
   c. Maximum loading 40 psi.
   d. Height of ribs: not to exceed 0.7 times width.
2. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

C. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

2.14 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches high.

2.15 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color-coded head.

2.16 LOCKOUT DEVICES

A. Lockout Hasps: Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

2.17 PAINT

A. Factory Finished Equipment: See individual equipment specification.

B. Ductwork: Paint interior of ductwork visible through grilles and diffusers with a flat black paint. Prepare and paint surfaces in accord with Division 9. The contractor’s attention is drawn specifically to the return and exhaust air grilles from the main library areas.

2.18 SEISMIC SUPPORTS

A. Provide seismic support as required by IBC 1613 and local authorities.

B. Sway bracing for ductwork, piping, and equipment shall consist of steel angles, rods or pipes. Shapes, lengths and methods of attachment shall be in accord with SMACNA “Guidelines for Seismic Restraints of Mechanical Systems”.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond of adhesives or firestopping.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before drilling or cutting structural members.

E. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 INSTALLATION-CLEARANCE

A. Appliances and equipment shall be accessible for inspection, service, repair and replacement.

B. Clearance shall be provided for the replacement of filters.

C. A minimum of 30” of clearance shall be provided in front of the control side of appliances and equipment. Provide additional space when required by NEC.

D. All control components shall be accessible for inspection and replacement.

### 3.3 INSTALLATION-PIPING PROTECTION

A. Provide protective shield plates in concealed locations where piping, other than cast-iron or steel, is installed in studs, joists or rafters. Plates shall be 16 gage steel and cover the pipe area plus 2”. Shields may be omitted if piping is more than 1-1/2” from nearest edge of structural member.

### 3.4 INSTALLATION – DUCTWORK

A. Locate hangers, supports and accessories to handle loads imposed by ductwork, and air distribution devices and with maximum spacing noted.

B. Support all ductwork to prevent sag, undue play and swing.

C. Maximum support spacing per SMACNA standards. Spacing shall not exceed 10 feet.

D. Assemble and install hangers and supports on ductwork.

E. All supports and attachments for exposed ducts shall have non-removable fasteners.

F. Attachments to fireproofed steel structure shall be made prior to spraying of fireproofing material. If necessary to disturb fireproofing after initial spraying, provide respraying or repairs necessary to restore the integrity of the fireproofing.

G. Adjust hangers and supports as required to bring system to proper line and grade. Ductwork shall be plumb with floor and parallel/perpendicular to building structure.

3.5 INSTALLATION – SEISMIC CONTROLS

A. Provide seismic restraints and hangers in compliance with IBC 1613 and ASCE 7.

3.6 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Use manufacturer's wall or ceiling engineering brackets. Or construct supports of formed steel channel or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

3.7 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

3.8 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal watertight.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with insulation and caulk or fireproof airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

3.9 INSTALLATION – ACCESS PANELS

A. Furnish access panels for installation at all concealed equipment which requires service, maintenance or adjustment to include but not limited to equipment, dampers, control valves, filters and controls.

B. Provide location layout and required size for all access panels to general contractor. Layout shall be regular and consistent, maintain a uniform wall panel height of 24” center line above finished floor, unless noted otherwise.

C. Furnish fire rated access panels where installed in fire rated assembly.

D. Provide stainless steel access panels where installed in tile surfaces.

E. Furnish access panels to general contractor for installation

F. Paint installed access panels to match wall or ceiling. Verify that panels are not painted shut.

3.10 INSTALLATION – FIRESTOPPING AND SEALS AT PARTITIONS

A. Installation of Firestop shall be performed by either a specialty contractor specializing in firestop application (FM G 4991 or UL Qualified Firestop Contractor), or general or sub-contractors with experience in similar applications and projects with installers qualified, trained, and certified by the firestop manufacturer. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures.

B. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

C. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

D. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

E. Install dams when required to properly contain Fire stopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the Firestop system.

F. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

G. Place intumescent coating in sufficient coats to achieve rating required.

H. Clean adjacent surfaces of firestopping materials.

3.11 INSTALLATION - PENETRATIONS OF NON-RATED SURFACES

A. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:

1. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
2. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

B. Install escutcheons where piping penetrates non-fire rated surfaces in occupied spaces.

C. Interior partitions: Seal pipe penetrations air tight. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.12 INSTALLATION-VIBRATION ISOLATION

A. Install isolation for motor driven equipment.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

3.13 INSTALLATION-IDENTIFICATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install tags using corrosion resistant chain. Use plain English designations so no index or chart is required.

D. Nameplates: Identify mechanical equipment (air handling units, air terminal units, pumps, heat transfer equipment, tanks, and water treatment devices) with plastic nameplates.
1. Identify in-line pumps and other small devices with name tags.
2. Identify control panels and major control components outside panels with plastic nameplates.
3. Identity description should be as numbered on drawings or plain English description.
4. Label automatic controls, instruments, and relays. Key to control schematic.
5. Label wall controls and switches with associated equipment designation and control function.
6.

E. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

F. Equipment and Valve Tag Index: Plain English designations so no chart or index is required.

3.14 CLEANING

A. Contractor shall make all mechanical components free of dust and dirt prior to startup.

3.15 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 230593

# TESTING, ADJUSTING AND BALANCING

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SCOPE

A. Testing, adjusting and balancing of air systems.

B. Testing, adjusting and balancing of Division 22 domestic water systems per WSREC and ESDS credit 5.01a.

C. Measurement of final operating conditions of above systems.

D. Duct pressure (leakage) testing as required by 23 31 00.

E. Preparation of formal report.

### 1.3 PERFORMANCE CRITERIA

A. Work shall be performed by approved independent testing and balancing agency.

B. Perform testing and balancing in accordance with Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). All work shall be supervised.

C. Calibrate instruments used for testing and balancing within a period of six months of start of work.

D. Mechanical contractor shall assist Balancing Agency in testing and balancing of mechanical system.

### 1.4 SUBMITTAL

A. Provide a PDF copy to design team for review.

B. Provide revised PDF copy of updated and/or corrected report.

### 1.5 FORMAT

A. Report shall consist of test sheets similar to AABC Standard Forms for Diffusers and Grilles, Air Handling Equipment, Exhaust Fans, and Pumps (i.e., Form 12666 for Diffusers and Grilles).

B. Report shall include the following.

1. Preface suggesting abnormalities and problems encountered.
2. Instrumentation List including type, model, manufacturer, serial number, and calibration dates.
3. System Identification reporting location of equipment, zones, supply, return, and exhaust openings.
4. Record following for each piece of air handling equipment, as applies.
    a. Manufacturer, model number, and serial number.
    b. Design and manufacturer rated data.
    c. Actual CFM
    d. Suction and discharge static pressure of each fan.
    e. Outside-air and return-air total CFM.
    f. Actual operating current, voltage, and brake horsepower of each fan motor.
    g. Final RPM of each motor.
    h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
    i. Belt size and quantity.
    j. Static-pressure controls final operating set points.

1.6 QUALIFICATIONS

A. Work of this section shall be performed by independent Air Testing and Balance Agency specializing in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.

B. Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing. Work by this Agency shall be done under direct supervision of qualified heating and ventilating engineer employed by Agency.

C. Agency shall be approved in writing by Architect.

D. Neither Architect's engineering consultant nor anyone performing work on this Project under Division 23 shall be permitted to do this work per the Washington State Energy Code.

1.7 ACCEPTABLE TEST AND BALANCE COMPANIES

| | | |
|---|---|---|
| A. | AIRTEST Co., Inc. | 425-313-0172 |
| B. | Neudorfer Engineers, Inc. | 206-621-1810 |
| C. | Hardin & Sons | 253-862-6645 |

PART 2 PRODUCTS

Not Used.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify systems are complete and in good working order before commencing work. Then, put all systems and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions and cleaning of systems have been completed. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Service and balancing valves are open.

### 3.2 PREPARATION

A. If requested, conduct tests in presence of Architect.

B. Instruments used by Agency shall be accurately calibrated and maintained in good working order.

C. Furnish instruments required for testing, adjusting, and balancing operations including ladders, scaffolding, additional dampers and clean filters.

D. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

E. During balancing technician's initial test of air handling systems, the Mechanical Contractor shall have his sheet metal foreman present to assist in any drive changes or dampers necessary.

### 3.3 INSTALLATION TOLERANCES

A. Diffuser, register and grille air flow rates shall be measured and adjusted to deliver final flow rates within 10% and within 50 cfm of design rates, whichever is less.

B. Fan air flow rates shall be measured and adjusted to deliver final flow rates within 10% and within 100 cfm of design rates, whichever is less.

C. Water flow rates shall be measured and adjusted to deliver final flow rates within 10% and within 5 gpm of design rates, whichever is less.

## 3.4 ADJUSTING

A. Ensure that clean filters, of the type specified, are installed prior to air balancing.

B. Provide additional volume dampers as necessary to accomplish design balances.

C. Check motors for proper rotation, coupling and drive alignment, belt tension and freedom from vibration, etc.

D. Verify recorded data represents actual measured or observed conditions.

E. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

F. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

G. Report defects and deficiencies noted during performance of services, preventing system balance.

H. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

I. After completion of testing and balancing, operate systems under normal conditions for at least two days of 8 hours each to demonstrate specified performance.

## 3.5 AIR SYSTEM PROCEDURE

A. Perform soloing testing and balancing functions in accordance with Associates Air Balance Council National Standards.

B. Adjust air handling and air distribution systems to obtain design supply, return, and/or exhaust air quantities.
   1. Test and adjust total system CFM by adjustment of fan speeds.
   2. Perform tests at high and low speeds of variable speed systems.
   3. Adjust branch air quantities by damper regulation. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open to minimize throttling losses.
   4. Measure air quantities at air inlets and outlets.

C. Diffusers, Registers and Grilles:
   1. Adjust air distribution to obtain uniform space temperatures free from objectionable drafts.
   2. Use volume control devices to regulate air quantities only to the extent that the adjustments do not create objectionable air motion or sound levels.
   3. Effect volume control by using volume dampers located in ducts.

D. Provide system schematic:
   1. Identify the location and area of each grille, diffuser, register, and terminal box.
   2. Record the required and actual air quantities at each outlet or inlet.
   3. Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.

E. Air Temperature:
   1. Measure wet and dry bulb air temperatures on entering and leaving side of ERV core.

F. Pressure:
   1. Measure static pressure conditions on air units, including filter and coil pressure drops, and total pressure across fan with suction and discharge pressures.
   2. Make air balancing allowances for 50 percent loading of filters.

G. Electrical:
   1. Record nameplate motor current and voltage.
   2. Measure actual motor current and voltage at balanced condition.

H. Dampers:
   1. Adjust outside air, return air, and exhaust dampers for design conditions.
   2. At modulating damper locations, take measurements and balance at extreme conditions.

I. Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.

## 3.6 FINAL INSPECTION AND ADJUSTMENTS

A. System shall be balanced and reports submitted before substantial completion inspection.

B. Balancing Agency shall be represented at inspection meeting(s) by qualified testing personnel with balancing equipment and two copies of current air balancing test report.
   1. Architect will choose and direct spot balancing. Differences greater than specified tolerance between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building and submission of a new test report. In such case a new inspection will be made.
   2. If re-balancing is required, submit revised air test and balance reports to Architect before Substantial Completion.
   3. Spot balance and rebalance shall be performed at no additional cost to Owner.

C. Where systems provide over 5 percent more air than schedule requirements, rooms supplied by that system shall have their supply air quantities increased by ratio of actual total air quantity supplied to minimum air quantity required by system schedule.

3.7 SUPPLEMENTAL WARRANTY

A. Test and balance agency shall include an extended warranty of 90 days, after occupancy, during which the Owner's representative, at his discretion, may request a recheck or resetting of any outlet, supply air or exhaust fan, as listed in test report.

END OF SECTION

# SECTION 230700

# HVAC INSULATION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 QUALITY ASSURANCE

A. Insulation must have maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. All systems components subject to heat loss or gain, such as, piping, storage tanks, vessels, valves etc. shall be insulated to conform with the Washington State Residential Energy Code and ESDS (as minimum) and this section.

### 1.3 IDENTIFICATION

A. Insulation shall bear a manufacturer's mark indicating the product R-value or K-value and thickness. This mark shall be visible after installation and shall be repeated at an interval of no more than 10 feet.

B. External duct insulation shall be legibly printed or identified at intervals not greater than 36 inches with name of manufacturer, R-value, thickness, flame spread and smoke-developed index.

C. R-values shall be based on insulation only at 75 F mean temperature difference.

D. For rigid or spray foam the aged R-value per inch shall be provided in submittals.

## PART 2 PRODUCTS

### 2.1 GLASS FIBER, BLANKET

A. Manufacturers: Johns Manville Micro-Flex or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Insulation: Semi-rigid, shot-free, continuous fiber, noncombustible. ASTM C1393.
1. 'K' factor: 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
4. Density: 2.5 lb/cu ft.

C. Vapor Retarder Jacket: reinforced facing, will accept paint. Seal with pressure sensitive tape.

2.2 POLYOLEFIN INSULATION

A. Manufacturers: IMCOA or similar.

B. Polyolefin or Polyethylene pipe insulation is **NOT ACCEPTABLE** for any application.

2.3 ELASTOMERIC CELLULAR FOAM (PIPE)

A. Manufacturers: Armacell AP/Armaflex, Aeroflex Aerocel or approved equal.

B. Preformed flexible, closed-cell, elastomeric thermal insulation: Type I, Tubular form, self-seal or continuous, 25/50-rated, CFC free, low VOC, 'K' factor: 0.27 at 75 degrees F. ASTM C534.

C. Rigid clamp/hanger insert: Armacell Armafix, polyurethane insert and aluminum jacket, single piece with self-adhering closure.

2.4 GLASS FIBER DUCT WRAP

A. Manufacturers: Johns Manville Microlite XG 75 or equal by Owens-Corning, Knauf, Manson or approved equal.

B. Description: Formaldehyde-free, flame-attenuated glass fibers bonded with thermosetting acrylic resin, FSK facing.
1. ‘ASTM E84, UL 723
2. Installed R Value: 1-1/2" R-4.2, 2” R-5.6, 3” R-8.3.
3. Maximum Service Temperature: 250 degrees F.
4. Density: 0.75 lb/cu ft

C. Vapor Retarder Jacket: Reinforced FSK facing. Seal with pressure sensitive 2” tape.

D. Identification: At intervals not greater than 36” print the name of manufacturer, the thermal resistance R-value at insulation thickness, the flame spread and smoke developed indexes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping and equipment has been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Apply insulation when building is thoroughly dry to prevent shrinkage.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

E. Finish insulation at supports, protrusions, and interruptions.

F. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

G. Insulate exhaust air ductwork where it is outside the insulated building envelope to prevent condensation.

H. For all insulated ductwork:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

I. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

## 3.3 SCHEDULES

A. Ductwork: Provide on ductwork as listed below. Insulation thickness is provided as reference; each application must meet minimum installed R-Value.

| Service | Location | Insulation Type | Approx. Thickness | Min. Installed R-Value | Jacket |
|---|---|---|---|---|---|
| Supply, Return | Attic, crawlspace or uninsulated areas within building. | Duct Wrap | 3" | R-8 | FSK |
| Supply, Return, Exhaust | Unconditioned Space Inside Bldg. | Duct Wrap | 2.5" | R-6 | FSK |

| | | | | | |
|---|---|---|---|---|---|
| Supply | Concealed Space (3) | Glass Fiber Duct Wrap | 1-1/2" | R-3.3 | FSK |
| Supply | Exposed (4) in Space With Supply Air Temp ≤55 F or ≥105 F | Glass Fiber Duct Wrap / Duct Liner | 1-1/2" | R-3.3 | FSK |
| Supply | Exposed in Space With Supply Air Temp Between 56-104F | None, Except Duct Liner if shown on Plans. | | | |
| Outside Air | Within Building <2800 cfm (4) | Glass Fiber Duct Wrap / Duct Liner | 3" | R-8 | FSK |
| Exhaust Air | Outside the Insulated Building Envelope | Glass Fiber Duct Wrap | 2" | R-6 | FSK |
| Exhaust Air | Between backdraft damper & building exterior. | Glass Fiber Duct Wrap | 3" | R-7 | FSK |

1. Secure duct wrap with mechanical fasteners spaced 12” on center, minimum. For horizontal ducts 24” or more in width, duct wrap shall also be secured with mechanical fasteners spaced 18” on center, on centerline of bottom of duct.
2. Insulation is not required on sound lined ductwork with sufficient insulating value.
3. Concealed space: Any space within the insulated building envelope that is concealed from view, i.e. behind ceiling, wall, shaft, soffit, etc.
4. For exposed ductwork in finished spaces which is required to be insulated provide internal liner with equivalent R-value.
5. Insulation required from exterior to shutoff damper or equipment. After damper provide R-7 insulation.

END OF SECTION

# SECTION 23 31 00

# HVAC DUCTS AND CASINGS

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

B. Standards: Comply with most stringent requirements and recommendations of International Mechanical Code or SMACNA (Sheet Metal and Air Conditioning Contractors National Association) Duct Construction Standards for fabrication, construction and sealant of duct, fittings, and accessories.

### 1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

## PART 2 PRODUCTS

### 2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.

B. Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

### 2.2 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Thermaflex G-KM or approved equal.

B. Product Description: Black polymer film supported by helical-wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film, UL 181 Class 1 complying with NFPA 90A & 90B.
   1. Pressure Rating: 6 inches wg positive and 1 inches wg negative.
   2. Maximum Velocity: 5000 fpm.
   3. Temperature Range: -20 degrees F to 250 degrees F.
   4. Thermal Resistance: R-4.2

C. Accessories:
   1. Hanger Strap: Thermaflex FlexTie – 1-1/2” wide, adjustable, plenum rated.
   2. Elbow: Thermaflex FlexFlow Elbow – One piece adjustable design installs over flex duct.

2.3 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers: McGill AirFlow, Semco or approved equal.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Joints: 16” and larger flange with gasket material.

D. Elbows: Smooth radius or 5 section, 1.5D.

E. Application: Required for all exposed round ductwork; all round ductwork 12” dia. and larger; all round ductwork with static pressure over 1” w.g.. Optional for all round ductwork.

F. Construct duct with the following minimum gages:

| Diameter | Gauge |
|---|---|
| 3 inches to 14 inches | 26 |
| 15 inches to 26 inches | 24 |

G. Construct fittings with the following minimum gages:

| Diameter | Gauge |
|---|---|
| 3 inches to 14 inches | 24 |
| 15 inches to 26 inches | 22 |

2.4 SINGLE WALL ROUND DUCTS (SNAP-LOCK)

A. Product Description: **Only allowed in concealed areas. For residential ventilation ductwork only.**

2.5 DUCT SEALANT

A. Manufacturer: Design Polymerics, United McGill or approved equal.

B. Sealant shall be water based and formulated to withstand working temperatures of -25°F to +200°F. All sealants shall exceed 500 hours under ASTM C 732 (artificial weathering) and pass ASTM C 734 (low temperature flexibility after artificial weathering). All sealants shall be of an elastomeric nature, have a weight per gallon not to exceed 12.5, have solids by weight of 66% ± 2%, pass UL 723 with a flame spread of 5 and smoke developed of 5.

2.6 DUCTWORK FABRICATION

A. Fabricate and support rectangular and round ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures corresponding to the ESP (external static pressure) of the fan system  Minimum of SMACNA 2” w.g. pressure standard.

B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

C. Indicated dimensions on drawings are net inside. Allow for thickness of duct lining where indicated.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Make field measurements to establish locations of hangers and supports where installation will not damage building construction.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Where ducts pass through partitions, ceilings or floors. Provide 1" clearance and insulate from structure with insulation material. Provide flanged sheet metal closure.

D. Where ducts pass through rated walls or assemblies without fire dampers, provide 1/4” to 1” annular space and fill with firestop sealant. Ductwork shall be minimum 26 gauge metal.

E. Isolate joints between dissimilar metals with fiber gasket.

F. Drawings do not attempt to show all offsets in ductwork. Make such offsets as necessary for installation of work without additional cost to Owner. 15 degree maximum angle of offset.

G. All exposed ductwork shall be Appearance Grade as set forth below (ductwork located in crawl spaces, shafts, and suspended ceiling spaces is not considered exposed).
1. All round ductwork shall be spiral seam (no snap-lock joints).
2. All joints clean and workmanlike.
3. Ductwork entirely free of dents.
4. Ductwork subject to denting due to space function construct one gauge heavier than SMACNA standard for size indicated.
5. All hangers trimmed of excess metal.
6. Plumb, level, parallel or perpendicular to building structure.
7. Sealed with transparent, paintable sealant to avoid streaking.

H. Flexible Duct:
1. Install insulated flexible duct in full extended condition free of sags and kinks.
2. Use minimum length required to make connection.
3. Length shall not exceed 6 feet.
4. Supported on 36" centers with minimum 1-1/2” wide strap. Do not crush.
5. Connect flexible ducts to metal ducts with draw bands.

I. Install duct hangers and supports in accordance with Section 23 05 00.

J. Use double nuts and lock washers on threaded rod supports.

## 3.3 DUCT SEALING

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Ductwork shall be sealed using welds, gaskets, or mastic. Duct tape is not permitted as a sealant on any ducts with the exception of that on fiberglass ducts specifically made for such use.

B. For all ductwork seal all transverse joints and longitudinal seams.

C. Low pressure ductwork (less than 3” w.g.) shall be sealed to a leakage rate not to exceed 6 percent of the system airflow. All deficient ductwork shall be re-sealed until compliant.

## 3.4 INTERFACE WITH OTHER PRODUCTS

A. Connect air outlets and inlets to supply ducts with six foot maximum length of flexible duct. Do not use flexible duct to change direction.

## 3.5 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

## 3.6 SCHEDULES

A. Ductwork Material Schedule:

| AIR SYSTEM | MATERIAL |
|---|---|
| Supply, Return, Exhaust, Relief | Galvanized Steel |
| Outside Air Intake | Galvanized Steel |

END OF SECTION

SECTION 233700

# AIR OUTLETS AND INLETS

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 QUALITY ASSURANCE

A. Diffuser, register, and grille performance shall be tested and rated in accordance with ASHRAE 70.

B. Louver performance shall be tested and rated in accordance with AMCA 500.

## PART 2 PRODUCTS

### 2.1 SUPPLY REGISTER

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Contoured and individually adjustable blades, 3/4" blade spacing, two-way deflection.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D. Fabrication: Steel with factory white enamel finish.

### 2.2 EXHAUST/ RETURN GRILLE

A. Manufacturers: Titus, Price, Krueger or approved equal.

B. Type: Fixed blades, 1/2 inch blade spacing, with blades set at 35 degrees.

C. Frame: 1-1/4 inch margin with countersunk screw mounting, welded corners.

D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, with factory white enamel finish.

E. Accessories:
1. Opposed blade damper.
2. Field fabricated steel plenum, internal baffle and round side duct inlet assembly.

2.3 LOUVERS

A. Manufacturers: Greenheck, Ruskin or approved equal.

B. Product Description: Stationary, dual drainable blade. AMCA certified.

C. Type: 6 inch deep with blades on 45 degree slope, heavy channel frame. Minimum initial point of water penetration of 1100 fpm.

D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory 2-coat 70% Kynar finish, color to be selected.

E. Mounting: Furnish with flanges, mullions, and hardware for installation.

F. Bird Screen: Aluminum 3/4" x 0.051” flattened expanded metal.

2.4 CAPS

A. Pitched Roof Cap: Steel construction with black enamel finish, integral flashing flange, built in birdscreen with damper. Greenheck RJ (6x9 or larger) or approved equal.

B. Flat Roof Cap: All aluminum exterior construction, galvanized steel internal supports, integral birdscreen without damper, built in flashing flange. Greenheck GRSF or approved equal.

C. Wall Cap (round connection): Aluminum construction, aluminum finish, built in birdscreen with damper. Greenheck WC or approved equal.

D. Wall Cap (rectangular): Steel construction with black enamel finish, built in birdscreen with damper. Greenheck WC or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations with Architectural Plans.

B. Verify ceiling/wall type before ordering.

C. Verify diffuser air patterns are as indicated before starting air balance.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. This specifically includes the return and exhaust air plenums located behind wood screens on this project.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 23 72 00

# ENERGY RECOVERY UNITS

## PART 1 GENERAL

### 1.1 QUALITY ASSURANCE

A. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.

B. Blowers shall be AMCA Certified for airflow.

C. Energy Wheel shall be AHRI Certified per Standard 1060.

### 1.2 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated hydronic, gas and electrical systems.

B. Contractor shall coordinate with roofing contractor to ensure curb unit is properly flashed.

### 1.3 EXTRA MATERIALS

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. Filters: 3 sets of disposable filters for each unit.
   2. One set of fan and energy wheel belts

### 1.4 ELECTRICAL

A. Short-Circuit Current Rating (SCCR): All HVAC and refrigeration equipment with multi-motor or combination electrical loads shall comply with NEC 110.10 & 440.4 and must include a SCCR greater than the Available Interrupting Current (AIC) of the electrical circuit serving the equipment. See electrical drawings for required AIC kA rating. Equipment SCCR may be presented in writing from the manufacturer or shown on the unit nameplate.

## PART 2 PRODUCTS

### 2.1 ENERGY RECOVERY VENTILATOR (ERV)

A. Manufacturer: Broan B130E65RTor approved equal.

B. Quality Assurance:
   1. Tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the UL label.
   2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

3. HVI Certified.
4. Manufactured in a facility registered to ISO 9001 and ISO 14001.
5. Energy Transfer Core shall have a five (10) year warranty against defects in material or workmanship from date of installation. The heat recovery core has a limited lifetime warranty.

C. General:
1. Factory assembled, wired and run tested.
2. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters.
3. Motorized damper within unit (no additional backdraft dampers required).
4. No drain required.
5. Virtuo constant airflow and auto-balancing device.
6. The unit shall have factory installed control board with functions for local, remote, and optional control modes.

D. The cabinet shall be fabricated of galvanized steel with a painted door. One-piece molded insulation shell for no air leakage (expanded polystyrene; UL 94-HF-1 certified).

E. ECM blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow. The blower motors shall be directly connected to the blower wheels and have permanently lubricated bearings. Integrated electronic airflow measurement device with real time LCD.

F. The heat exchanger element shall be constructed of Polypropylene crossflow core with polymeric membrane and aluminum covers. It is impact resistant and non-washable. Total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions. Protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.

G. Filters: MERV 13

H. Control options as specified on drawings:
1. Automatic
2. Speed Selector
3. Advanced Touchscreen
4. 20-40-60 Deluxe

I. Accessories:
1. Wall mount bracket (4 mount bracket)

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Secure unit with wall bracket to studs.

B. Install flexible connections between unit and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

3.2 MANUFACTURER'S FIELD SERVICES

A. Furnish services for minimum of one day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.3 CLEANING

A. Vacuum clean coils and inside of fan cabinet.

B. Install clean filters.

3.4 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 83 23

# ELECTRIC UNIT HEATERS

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Electric unit heaters.
   2. Electric wall heaters.

## PART 2 PRODUCTS

### 2.1 ELECTRIC UNIT HEATERS

A. Manufacturers: King, Markel, Reznor or approved equal.

B. Assembly: UL listed and labeled assembly with terminal box and cover. Complete with mounting bracket.

C. Heating Elements: Spiral fin steel element with continuously brazed steel fins.

D. Cabinet: 18 gauge steel with powder coated finish, hinged and latched access door, overheat protection, individually adjustable horizontal louvers.

E. Fan and Motor: Direct-drive propeller type, statically and dynamically balanced, with fan guard. Permanently lubricated, totally enclosed motor.

### 2.2 FORCED AIR WALL HEATER (TAMPERPROOF)

A. Manufacturers: King, Markel, Cadet or approved equal.

B. Heavy gauge housing and frame with sealed tubular heating element, thermal overload cut-off, fan delay switch, built-in tamperproof thermostat, vane axial blower. UL listed.

### 2.3 FORCED AIR WALL HEATER

A. Manufacturers: King, Markel, Cadet or approved equal.

B. 18-gauge powder coated housing and frame, white. Sealed tubular heating element, thermal overload cut-off, fan delay switch, built-in double pole adjustable thermostat, vane axial blower. Without summer fan switch. UL listed.

### 2.4 FORCED AIR WALL HEATER (FREEZE PROTECTION)

A. Manufacturers: King, Markel, Cadet or approved equal.

B. Heavy gauge housing and frame with sealed tubular heating element, thermal overload cut-off, fan delay switch, built-in tamperproof thermostat set to 45F for freeze protection, vane axial blower. UL listed.

2.5 COVE HEATERS

A. Manufacturers: King, Markel, Cadet or approved equal.

B. Extruded aluminum ribbed front panel with minimum cross section thickness of 0.962". Open on top and bottom for maximum convection heating. Element wattage density of approximately 150 watts per linear foot. Full length back case constructed of 22 gauge electrogalvanized steel with baked enamel finish. UL listed.

2.6 THERMOSTATS

A. DWELLING UNIT BEDROOMS:
1. Line Voltage Heating Thermostat (Electronic): King ES120/230, Honeywell TL7235A or equal.
a. Integral manual On/Off switch, single-pole.
b. Accuracy: +/- 1.5 degrees F.
c. Load / Motor capacity rating of 22 amps, 115/208/240 volt.
d. Electronic thermistor temperature sensor with 40 F to 95 F range.
e. LCD display showing setpoint, Green LED backlight, Red LED heat on Indicator, temperature adjustment buttons.
f. Positive off position/function to serve as NEC required disconnect.

B. DWELLING UNIT LIVING AREAS:
1. Line Voltage Heating Thermostat (Programmable Electronic): King ESP230, Honeywell TL8230A or equal.
a. Integral manual On/Off switch, single-pole.
b. Accuracy: +/- 1.5 degrees F.
c. Load / Motor capacity rating of 22 amps, 208/240 volt.
d. Electronic thermistor temperature sensor with 40 F to 95 F range.
e. 7 day independent programmable schedules with 4 daily setpoints.
f. LCD display showing day, time, room temperature and setpoint, Green LED backlight, Red LED heat on Indicator, temperature adjustment buttons.
g. Positive off position/function to serve as NEC required disconnect.

PART 3 EXECUTION

3.1 EXAMINATION

A. For recessed units, verify recess dimensions are correct size.

B. Verify wall construction is ready for installation.

C. Verify concealed blocking and supports are in place.

## 3.2 INSTALLATION

A. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

B. Protection: Install finished cabinet units with protective covers during remainder of construction.

C. Unit Heaters: Hang from building structure, provide seismic bracing. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

D. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

## 3.3 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

# SECTION 26 00 00

# ELECTRICAL GENERAL CONDITIONS

## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Divisions 26, 27 and 28.

### 1.2 SUMMARY

A. Design Intent: The project includes Electrical, Fire Alarm and Low Voltage systems for a 12-unit, three story residential apartment project located in Kirkland WA. The Division 26 Electrical scope is full design per these specs and the supporting project contract documents. All Fire Alarm and Low Voltage Systems are Design-Build; Contract Documents (drawings and specifications) are meant to provide information (scope, performance requirements, preliminary quantities and locations, etc) for Bidding by Design-Build Contractors only. All final quantities and locations of equipment and devices shall be coordinated with the Fire Marshal/ Local AHJ (as applicable), Architect and Owner prior to the start of construction. The Electrical Contractor and their subcontractor(s) shall design, permit and provide complete and fully operational and coordinated Electrical and design and provide Fire Alarm and Low Voltage systems that meet all requirements of the Owner, local AHJ and as per the Project Contract Documents.
   1. The Fire Alarm and Low Voltage Design-Build Contractor(s) shall be a subcontractor(s) to the Electrical Contractor.
   2. Fire Alarm System:
      a. In addition to administrative requirements of this Specification Section, see Specification Sections 28 46 00 and the Contract Drawings for system performance requirements for bidding by the Fire Alarm Design-Build Contractor.
   3. Low Voltage Systems:
      a. See Specification Section 27 00 00 for a complete list of Low Voltage Systems to be included in the Project.
      b. In addition to administrative requirements of this Specification Section, see all Division 27 and 28 Specification Sections and the Contract Drawings for system performance requirements for bidding by the Low Voltage Design-Build Contractor.

B. Sustainability Goals: The Project is pursuing Evergreen Sustainable Development Standards (ESDS) Certification. The Electrical Contractor shall coordinate with the Architect and General Contractor to ensure compliance with the Prerequisites and intended Credits for the project. See Division 01 Specification and subsequent Division 26, 27 and 28 Specifications for additional information and requirements.

C. The Electrical Contractor shall provide all labor, materials, equipment and devices, supports, etc necessary for satisfactory installation of electrical work ready to operate in strict accordance with Code requirements and the Project specifications and drawings.

D. Related Sections: All Division 01, 26, 27 and 28 Specification Sections included in the Contract Documents.

E. Commissioning Activities and Submittals: The Project shall be commissioned per Energy Code and ESDS requirements. The Contractor shall coordinate with the General Contractor, Architect and Commissioning Agent and provide support for the complete commissioning process as required. See Divisions 01, 26, 27 and 28 for additional information.

1.3 CODES AND STANDARDS:

A. All work shall meet or exceed the requirements of the current versions of all applicable Federal, State, and Local Codes and Standards including but not limited to:
1. National Electrical Code (NEC) with Local Amendments / Washington Cities Electrical Code.
2. Washington State Energy Code with Local Amendments.
3. ESDS Requirements.
4. International Fire Code (IFC) with Local Amendments.
5. International Building Code (IBC) with Local Amendments.
6. International Mechanical Code (IMC) with Local Amendments.
7. Uniform Plumbing Code (UPC) with Local Amendments.
8. The Americans with Disabilities Act (ADA).
9. Illuminating Engineering Society of North America (IESNA) Standards and Recommended Practices.
10. National Fire Protection Association (NFPA) Standards and Recommended Practices.
11. Applicable Standards of the following organizations (see subsequent Division 26, 27 and 28 sections for additional information):
    a. American National Standards Institute (ANSI).
    b. American Society for Testing Materials (ASTM).
    c. Building Industry Consulting Services International (BICSI).
    d. Federal Acquisition Regulation (FAR).
    e. Institute of Electrical and Electronics Engineers (IEEE).
    f. National Electrical Manufacturer’s Association (NEMA).
    g. U.S. Department of Housing and Urban Development (HUD).
    h. Underwriter’s Laboratories (UL) standards.
12. Utility Service Provider Requirements.

1.4 SUSTAINABLE DESIGN REQUIREMENTS:

A. Comply with Project Requirements to achieve the Evergreen Sustainable Development Standard, Version 4.0, certification.

B. Comply with Construction Management Plan. Refer to Division 01.

C. ESDS-Compliant Products: Inside the building envelope, use materials that contain acceptable or lower levels of VOC per referenced standards in Rating System Requirements and no added urea-formaldehyde. Cleaning products used during construction and close-out procedures shall meet Green Seal standards GS-34, GS-37, and SG-40, or the California Code of Regulations, Title 17 Section 94509, VOC standards for cleaning products.

D. Refer to Division 01 for a complete list of ESDS Prerequisites and Credits anticipated for the project. The Contractor shall coordinate with the General Contractor and Architect to provide documentation and support for all applicable Prerequisites and Credits including but not limited to:
   1. LIST ALL ELECTRICAL AND LOW VOLTAGE-RELATED CREDITS AND PREREQUISITES THAT PROJECT IS ATTEMPTING.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, Fire Marshal, and UL for fire resistance ratings and surface burning characteristics.

1.6 PRODUCT SUBSTITUTIONS

A. Manufacturers and models of equipment and material indicated in Divisions 26, 27 and 28 Specifications and on drawings are those upon which the electrical design is based and upon which the fire alarm and low voltage systems' designs are to be based; other manufacturers with products considered equal in general quality may also be listed without specific model designation. Manufacturers not listed shall be submitted for approval prior to submission of Bid by the Contractor, see Division 01.

B. Any equipment other than the basis of design is considered a substitution; this includes equipment from any alternate manufacturers listed without specific model designation in the Contract Specifications and / or Drawings.

C. Pre-Bid Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

D. In selecting substitute equipment, the Contractor is responsible for and shall guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Approval of proposed substitution does not grant the Contractor approval for deviation from the contract requirements.

F. Unless indicated otherwise, "or approved equal" may be assumed for all products in Divisions 26, 27 and 28.

## 1.7 DESIGN DRAWINGS

A. All drawings, specifications and calculations prepared by the Fire Alarm and Electrical Design-Build Contractors shall be stamped by an Engineer currently registered in the State of Washington.

B. The Fire Alarm and Low Voltage Design-Build Contractor shall submit drawings and diagrams for review and for job coordination:
   1. Permit / Construction Drawings for review. These drawings shall be submitted at two milestones as selected by the Architect in electronic PDF format.
      a. The Contractors' drawings shall match the layout of the Architectural drawings.
      b. Fire Alarm systems shall be provided in a separate set of drawings by the Fire Alarm Contractor.
      c. Separate drawings shall be provided for Power, Lighting, and Low Voltage systems unless the drawings are set up to the scale of 1/4" = 1'-0" or larger.
      d. The Drawing Sets shall include at a minimum:
         1) Symbols, Legend and drawing list sheets.
         2) Panel Schedules, Mechanical Connection Schedules, etc.
         3) Electrical Single-Line Diagram.
         4) Power Sheets.
         5) Lighting Sheets.
            a) Lighting sheets shall include illuminance calculations for emergency and non-emergency conditions showing compliance with Code requirements and IESNA recommendations.
         6) Low Voltage Systems (Telecom, CATV, access control, etc) floor plan drawings.
         7) Low Voltage Systems riser diagrams.
         8) Fire Alarm System sheets and calculations approved by the local Fire Marshal/ AHJ.

## 1.8 ELECTRICAL SYSTEMS STUDIES

A. As soon as the actual equipment being provided by the project has been selected by the Contractor, the Electrical Contractor shall perform Short Circuit / Fault Current, and Arc Flash Studies for the actual Electrical System to be installed.

B. These studies shall be prepared for the specific electrical equipment, overcurrent devices, utilization equipment and feeder and circuit lengths and types to be installed for the project.

C. Studies shall be prepared and stamped and signed by a professional Electrical Engineer currently registered in Washington State.

D. Studies shall be submitted with the Submittals for electrical panelboards, switchboards, overcurrent protective devices, etc. These equipment and devices will not be approved without the required Studies.

E. See Specification Section 26 05 73 for additional information and requirements.

1.9 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Divisions 26, 27 and 28 Specification Sections and all additional products noted on drawings or required for completion of sequence of operations.

B. Provide the Submittals so as not to delay the construction schedule; allow at least two weeks for review of each submittal and re-submittal.

C. Electronic: Submittals shall be complete in one PDF file for each Division with bookmarks for each Specification Section and Principal Category. Multi-file submittals will be returned without review.
1. First Page: Name of Project, Owner, Location & Contracting Company.
2. Index Page: List of specification sections and principal categories with contents by Tag or item.
3. Bookmarks: Electronic bookmark of each specification section and principal category corresponding to listing in index.

D. Clearly indicate on each page the equipment schedule designation (Tag or Mark) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

E. Equipment vendor cover page with contact information shall precede submittal by that vendor.

F. Submitted product information shall include but not be limited to the following information (as applicable):
1. Product description.
2. Manufacturer and model.
3. Dimensions.
4. Performance Ratings.
5. Construction Materials.
6. Finish.
7. Ratings (i.e. UL, ASTM, NEMA, etc).
8. Electrical characteristics (Voltage, Phase, Wattage, Breakers, etc).
9. Engineering technical data.
10. Sound level data.
11. Vibration isolation.
12. Strength and fastening provisions.
13. Seismic qualification data.
14. Controls and wiring diagrams.
15. Accessories.

G. Where a third party structural engineer has been engaged by the Contractor to provide support, anchoring and seismic calculations, the Contractor shall include these calculations and designs in their Submittal Package.

H. If requested in subsequent Specification Sections or by the Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

I. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

J. The Contractor agrees to pay for the Engineer's review cost of the Division 26, 27 and 28 Submittals beyond one resubmittal where resubmittals are required due to deficiencies in the Contractor's Submitted material.

1.10 SHOP DRAWINGS

1. For Electrical Gear (switchboards, panelboards, etc).
2. For Lighting Control Systems.
3. Slab plans marked up with all penetrations required for electrical, fire alarm and low voltage systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.
4. As requested in subsequent Division 26, 27 and 28 Specification Sections.
5. For all special or custom-built items or equipment.
6. In all cases where deviation from the Contract Drawings are contemplated because of job conditions, interference or substitution of equipment, or when requested by the Engineer for purposes of clarification of the Contractor's intent.
    a. By submission of revised design shop drawings, the Contractor acknowledges that coordination has been done with all other trades to ensure that all equipment fits and remains accessible with all Code required clearances and that no conflicts exist.

B. The Architect's and Engineer's review of shop drawings shall not relieve the Contractor of the responsibility for deviations from the Contract drawings or specifications, unless he has, in writing, called the attention of the Architect to such deviations at the time of the submission, nor shall it relieve him from responsibility for errors or omission in such shop drawings.

1.11 ESDS RELATED DOCUMENTATION AND ACTIVITIES

A. Provide commissioning documentation as the Commissioning Authority (CxA) requests.

B. Construction Waste Management: Retain and submit all trip and tip tickets for all construction debris and waste removed from site, indicating material content, tonnage, date hauled and facility to where materials were hauled. This submittal is to the general contractor only.

## 1.12 UTILITY SERVICES

A. The Contractor shall verify the locations of any overhead or buried utilities on or near the Project site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

B. DEMOLITION OF EXISTING SERVICES
1. The Electrical Contractor shall coordinate with all utility service providers that serve the site (power, telecom, CATV, etc) to schedule the disconnection of all existing utility services on or serving the site that are to be demolished. See the Civil plans for additional information and requirements.
2. The Electrical Contractor shall coordinate with the General Contractor and the utility service providers to ensure that all existing utility services (power, telecom, CATV, etc) equipment, conduit, conductors, etc to be demolished are removed from the Project Site. See the Civil plans for additional information and requirements.

C. TEMPORARY (CONSTRUCTION) POWER
1. The temporary (construction) power system is design-build by the Electrical Contractor.
2. The Electrical Contractor shall design, permit, and install the temporary (construction) power system for the site.
3. The Electrical Contractor shall coordinate temp service requirements with the General Contractor.
4. The Electrical Contractor shall coordinate temp service to the site with the Electrical Utility.
5. The Electrical Contractor shall include in their Bid all costs associated with the design and installation of the temp power system per the requirements of the General Contractor, AHJ, and Utility.

D. NEW PERMANENT SERVICES
1. The Electrical Contractor shall coordinate scheduling and installation requirements with all Utility Service providers for the project (power, telecom, CATV, etc).
2. The Electrical Contractor is responsible for scheduling all Inspections required by the utility service providers in a timely manner, per the requirements of the utility service providers, so as not to delay construction.
    a. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work (including the electric and telecom utility providers for utility service infrastructure work).
    b. Should any work be enclosed or covered up before such inspection and testing, the Contractor shall at his own expense uncover said work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition including paying other trades to repair work under their scope that was disturbed.

3. The Electrical Contractor shall confirm final installation requirements for all utility service infrastructure (conduit sizes, locations and routing; vault/ pad locations and sizes; pull box locations and sizes; in-building vault installation requirements; final connection point locations; etc) with the Inspectors of the utility service providers serving the project.
4. All utility service infrastructure (conduits, pull vaults, equipment vaults, pull boxes, etc) shall be provided and installed per the requirements of the utility service providers.

1.13 COMMISSIONING

A. See Division 01 and Sections 26 08 00 and 27 08 00 / individual Section 26, 27, and 28 Spec Sections for additional roles and responsibilities of commissioning.

B. Provide all necessary commissioning assistance, equipment and documentation as required by the Commissioning Plan.

C. The duty and responsibility for electrical and low voltage commissioning work shall be assigned to a specific individual. Inform the General Contractor and Commissioning Agent of the contact information for the person so assigned.

D. Perform corrective actions needed to resolve deficiencies identified during commissioning. Record action taken on commissioning deficiency log.

1.14 PERMITS

A. See Specification Section 28 46 00 for Fire Alarm Systems Permit requirements.

B. In addition to the requirements in other Specification Sections, the Electrical Contractor shall make all required submissions to the Authorities Having Jurisdiction (AHJ) for Permits and approval. The Contractor shall pay all fees related to said submissions and shall submit all comments received from the AHJ to the Architect and Engineer.

C. The Contractor shall not commence work until a permit (or “get started” permit where allowed by the AHJ) is obtained. The Contractor is solely responsible for ensuring that the permit application and any revisions are submitted in a timely manner so as not to impact the project schedule.

D. The Contractor shall retain the services of a third party structural engineer to provide support, anchoring and seismic calculations for all applicable equipment where required by the AHJ.

1.15 QUALITY ASSURANCE

A. The Contractors shall perform all work per current versions of all applicable Codes and Standards with state and local amendments – see “Codes and Standards” paragraph above.

B. All equipment and devices shall be UL-Listed and Labeled and shall be acceptable to the Authority Having Jurisdiction as suitable for the use and location for which they are intended.

C. Provide all like items (receptacles, circuit breakers, electrical gear, etc) from one manufacturer.

1.16 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in Divisions 26, 27 and 28 Specification Sections with a minimum of three years' experience.

B. Installer: Company specializing in performing Work included in Divisions 26, 27 and 28 on projects of similar type and scale with a minimum of three years' experience.

1.17 SCHEDULING

A. Coordinate and provide assistance in final adjustment and testing of life safety systems with the General Contractor and Fire Authority.

1.18 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. The Contractor shall keep all equipment, devices, conduit, etc in a dry, secured, protected area. The location shall be coordinated with the Architect and General Contractor prior to the start of Construction. See Division 01 for additional delivery, storage and handling requirements.

C. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

D. Inspect all products and materials for damage prior to installation.

E. Protect conduit from all entry of foreign materials by providing temporary end caps or closures on conduit and fittings.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Comply with manufacturer's installation instruction for rigging, unloading and transporting equipment.

1.19 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Coordinate with General Contractor to have ventilation provided in areas to receive solvent cured materials.

C. Do not install underground conduit when bedding is wet or frozen.

D. Do not install equipment pads when ground is frozen or muddy.

1.20 FIELD MEASUREMENTS

A. Verify field measurements prior to ordering gear.

B. Verify by field measurements that equipment sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining and documenting exact locations of existing systems.

1.21 COORDINATION

A. The Contractor shall visit the site and become familiar with existing conditions affecting work. The Contractor shall include in their Bid the costs for all work and / or materials required to comply with the requirements of the Contract Documents based on the actual existing conditions. Failure to visit the Site and verify actual existing conditions does not relieve the Contractor of these requirements; no change orders will be paid due to lack of verification of existing conditions whether they are specifically noted in the Contract Documents or not.

B. The Contractor shall verify the locations of any overhead or buried utilities on or near the Project site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. Where the word ‘verify’ is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

E. Where the drawings or specifications call out for the contractor to field verify and / or coordinate locations and requirements this verification / coordination is to be completed prior to any equipment, devices, supports, conduits, etc are installed / roughed-in. Any equipment, devices, supports, conduits, etc installed at locations unacceptable to the design team (either for aesthetics or functionality) due to the contractor failing to field verify / coordinate shall be relocated at the contractor's expense.

F. Electrical and Low Voltage Systems drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments as necessary to fit actual conditions.

G. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or equipment roughed in improperly and not positioned on implied centerlines or as required by good practice shall be repositioned at no cost to the Owner.

H. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the Electrical, HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

I. Advise the Architect of any modifications required to suit the equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

J. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

K. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with the requirements of the Contract Documents.

M. Coordinate wall openings, rough-in locations, concrete housekeeping pads, and conduit rough-in locations to accommodate Work of Divisions 26, 27 and 28.

N. The Contractor shall coordinate with the Architectural plans and Project structure when locating equipment and devices and routing conduit and cabling.

O. The Contractor shall coordinate with the General Contractor and provide slab plans marked up with all penetrations required for electrical, fire alarm and low voltage systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.

P. The Contractor shall coordinate conduit and cabling routing and equipment and device locations with all other trades to ensure all Code required clearances are maintained and equipment and devices remain accessible after the work of all trades is complete.

Q. The Contractor shall consult the approved shop drawings of all other trades and crafts to ensure coordination with final locations of cabinetry, counters, appliances, equipment, structural members, etc. Conflicts are to be resolved with the Architect and General Contractor prior to rough-in. The Contractor shall not be paid for relocation work (including cutting, patching, and finishing) required due to a lack of coordination prior to installation.

R. See the Architectural drawings for the exact locations of electrical and low voltage devices. The Contractor shall make minor changes (less than 6-feet in any direction) in the location of conduit, boxes, devices, etc from the locations shown in the drawings without extra charge to the Owner where required by coordination or if directed by the Architect or Owner.

S. The Electrical Contractor shall coordinate with the mechanical and plumbing contractors to ensure that the electrical services and disconnects/starters/etc for all HVAC and plumbing equipment are appropriately sized and that all HVAC and plumbing loads are included in the electrical load calculations.

T. Short-Circuit Current Rating (SCCR): Coordinate final available fault currents per the Electrical Systems Studies with the Mechanical Contractor to ensure HVAC and refrigeration equipment have an SCCR rating as needed to meet Code requirements.

U. Motor Starters: By mechanical equipment manufacturer where factory mounted controls are provided. Variable frequency drives by Division 23. All other starters are to be provided by Electrical Contractor; coordinate with Mechanical and Plumbing Contractors to ensure compatibility with their equipment.

V. Wiring for HVAC Equipment:
1. Power Wiring for HVAC equipment: By Electrical Contractor.
2. Control Wiring for HVAC equipment: Responsibility of Division 23.
3. Owner will not entertain additional cost due to lack of coordination between HVAC Contractor and Electrical Contractor.

1.22 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout:
1. Walk through the Project with the Owner and Architect to make note of deficiencies.
2. Execution of Owner’s, Architect's and Engineer’s final observation reports (punchlist).
3. Operating and Maintenance Instructions.
4. Operating and Maintenance Manual.
5. Equipment and Lens Cleaning.
6. Record Drawings.
7. Testing.
8. Commissioning and Commissioning Report.
9. Warranty.

B. See other Division 26, 27 and 28 Specification Sections for additional requirements.

C. See Division 01 for additional requirements.

1.23 OPERATING AND MAINTENANCE INSTRUCTIONAL TRAINING

A. General: In addition to requirements of Division 01, following initial operation of Electrical systems and prior to acceptance by the Architect, perform the following services:
   1. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.
   2. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, lighting controls setpoint and system adjustment, and safeties and alarms.
   3. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier’s or manufacturer’s personnel, those personnel should also provide training on that equipment.
   4. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
      a. Provide documentation of all instruction which includes:
         1) Date and time of instruction.
         2) Name, affiliation and qualifications of the instructor.
         3) Name and affiliation of the attendees.
         4) Topics, systems, and equipment covered.
         5) Length of instruction.
   5. Minimum duration of instruction periods:

| | | |
|---|---|---|
| a. | Electrical Power Systems | 2 hours |
| b. | Lighting Control Systems | 1 hours |
| c. | Fire Alarm Systems | See Section 28 46 00 |
| d. | Low Voltage Systems | See Section 27 00 00 |

1.24 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 01, one PDF and one bound copy of operating and maintenance manuals to include the following:
   1. The Job name and address.
   2. Names, addresses and telephone numbers of the Contractor, sub-contractors and local companies responsible for maintenance of each system or piece of equipment.
   3. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   4. Written guarantees.
   5. Warranty service contractors' names, address and phone numbers (if different from above).

6. Copies of approved brochures and Shop Drawings as applicable for all submittal items.
7. Manufacturer's printed operating procedures to include start-up and routine and normal operating instructions; and control, shutdown, and emergency instructions.
8. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; and adjusting instructions.
9. Part numbers of all replaceable items.
10. Control diagrams and operation sequence.
11. Record drawings corrected and completed.
12. Completed systems start-up forms and checklists.
13. Final copy of testing reports.

B. Operation and Maintenance Data:
   1. Include spare parts lists for all equipment as applicable.
   2. Submit installation instructions, adjustment instructions, and spare parts lists for all equipment.
   3. Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
   4. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

C. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between Specification Sections and principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.
   3. Imprint on Cover:
      a. Name of Project.
      b. Owner.
      c. Location of project.
      d. Architect.
      e. Contractor.
      f. Year of Completion.
   4. Imprint on backing:
      a. Name of Project.
      b. Year of completion.

D. PDFs:
   1. Provide PDF with bookmarks for each Specification Section and Principal Category.
      a. First Page: Name of Project, Owner, Location & Contracting Company.
      b. Index Page: List of specification sections with contents by Tag or item.
      c. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

E. Submittal:

1. Preliminary Copies: Prior to scheduled completion of the project, submit one PDF copy for review by the Architect.
2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

1.25 RECORD DRAWINGS

A. Prepare record documents in accordance with the requirements of Division 01 Specification Section "Contract Closeout."

B. Label each drawing as "Record Drawing" with Electrical Contractors' name and date.

C. During construction, maintain an accurate record set of the drawings of the installation on project site at all times; keep this set in a safe location, protected from the environment.

D. Submit one digital file with all drawings in PDF format.

E. Make all notes and revisions on PDF set in red.

F. In addition to the requirements specified in Division 01 and in other Division 26, 27 and 28 Specification Sections, indicate installed conditions (locations, sizes, burial depths, arrangements, etc) for:
1. Major raceway systems – Interior and Exterior – dimensioned from prominent building lines.
2. Utility service conduit (power and telecom) and connections, dimensioned from prominent building lines.
3. Conduits provided for future use with intended future use identified, dimensioned from prominent building lines.
4. Control devices, equipment disconnects, distribution and branch electrical circuitry, and fuse and circuit breakers.
5. Equipment locations (exposed and concealed) shown to scale and dimensioned from prominent building lines.
6. Final schedules for panelboards, lighting controls, etc.
7. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.26 TESTING

A. Provide completed start-up forms and checklists.

B. Perform testing of electrical, lighting control, non-utility metering, fire alarm and other low voltage systems as described in Division 26, 27 and 28 Specification Sections and as required by applicable codes and ordinances.

C. Written verification of testing to be signed by Owner's Representative.

## 1.27 COMMISSIONING REPORT

A. Provide commissioning in compliance with Energy Code requirements, the commissioning notes in the contract documents and per the Project's Commissioning Plan.

B. Submit three (3) copies of the preliminary commissioning report as required by the Washington State Energy Code and as outlined on drawing commissioning notes and specifications. This report is an execution and fulfillment of the commissioning plan. This report shall be completed before the final electrical permit inspection. At a minimum this report shall include:
   1. Testing reports for systems required to be commissioned.
   2. Complete system startup checklists.
   3. Functional test reports.
   4. Sequence of Operation test reports.
   5. O&M Materials.
   6. Record Drawings.
   7. Owner training documentation.
   8. Notes of any discrepancies observed during testing and any corrective actions taken or date when corrective action will be taken.
   9. Notes of any tests which could not be performed due to conflicts (identify specific conflict that prevented testing from occurring).

C. After receiving review comments from the preliminary commissioning plan make corrections indicated and submit three (3) copies of the final commissioning report. At a minimum this report shall include the information from the preliminary commissioning report and the following:
   1. Corrective measures taken in response to preliminary report or field observation report.

## 1.28 WARRANTY AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. The Contractor shall, without cost to the Owner, correct all defects and failures discovered within one year from date of final acceptance for all electrical, fire alarm and low voltage systems, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.
   1. See individual Specification Sections for additional requirements.

C. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

D. The Contractor shall make all necessary lighting and receptacle control adjustments during first year of operation.

E. The presence of any inspector or observer at any point during construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

F. Refer to Division 01, 26, 27 and 28 Specification Sections for additional Warranty requirements.

PART 2 NOT USED

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction the Contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. The Engineer or Design-Build SubContractor (fire alarm) will revise and/or prepare drawings for submittal.

3.2 MOCK-UPS

A. The Electrical Contractor shall completely mock-up one of each typical unit type and the common areas (exact units and areas to be chosen by the Architect and Owner) by marking the intended locations of all equipment and devices (load centers, media boxes, luminaires, switches, receptacles, CATV and telecom outlets, thermostats, heaters/ HVAC equipment, etc).

B. Before starting installation of equipment and devices, the Electrical Contractor shall walk through all mocked-up areas with the Owner, Architect, and General Contractor to receive approval for all locations.

C. The Electrical Contractor shall relocate equipment and devices in the mock-ups per the Owner and Architect’s instructions.

D. The Electrical Contractor shall relocate any equipment and devices installed prior to the approval of the mocked-up areas by the Architect and Owner at the Electrical Contractor’s expense.

3.3 INSTALLATION

A. The Contractor shall conceal all conduit, cabling and boxes in finished areas unless indicated otherwise or granted specific permission by the Architect. Install all conduit and cabling perpendicular to or parallel with building lines wherever possible.

B. In open ceiling areas, all cabling shall be installed in conduit. In front of house (public) areas, conduit shall be painted; color as selected by the Architect.

C. Coordinate the locations of luminaires, lighting control devices and outlets with all other trades.

3.4 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work (including the electric and telecom utility providers for utility service infrastructure work).

B. Should any work be enclosed or covered up before such inspection and testing, the Contractor shall at his own expense uncover said work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition including paying other trades to repair work under their scope that was disturbed.

3.5 FIELD QUALITY CONTROL

A. Conducts tests of equipment, devices, and systems as required by NFPA, BICSI, local Codes and the local AHJ.
   1. Provide a Journeyman Electrician with all tools, instruments, etc required to complete required tests.
   2. Coordinate with the Owner, Architect and General Contractor; tests should be performed in the presence of the Owner and Architect unless given specific permission otherwise in writing.

B. Refer to individual Division 26, 27 and 28 Specification Sections for additional requirements.

3.6 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean interior and exterior of all equipment and luminaire lenses. Equipment shall be free of dirt, construction debris, corrosion, etc.

C. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of conduit and equipment. Any collection of material shall be thoroughly cleaned before owner occupancy.

D. Clean exterior of all exposed conduit.

E. Use ESDS Compliant Products: Materials intended for use inside the building envelope, including those used for patching, painting, touch-up, and cleaning, must contain acceptable levels of VOC’s per ESDS requirements and contain no added urea-formaldehyde.

3.7 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of electrical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting where possible by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for electrical installations.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.8 SALVAGE

A. Remove excess conduit and conductors. Remove scrap and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

3.9 MANUFACTURERS' FIELD SERVICES

A. Refer to individual Division 26, 27 and 28 Specification Sections for requirements.

3.10 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 26 00 00

# SECTION 26 05 00

# COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Hangers and Supports.
2. Concrete Bases.
3. Vibration and Seismic Controls.
4. Sleeves and Sleeve Seals.
5. Firestopping.
6. Access Panels.
7. Execution.

### 1.2 RELATED SECTIONS

A. In addition to the requirements in Divisions 01, 26, 27 and 28 Specification Sections, see also the following Specifications for additional information and requirements:

| | |
|---|---|
| 05 50 00 | METAL FABRICATIONS |
| 03 30 00 | CAST-IN-PLACE CONCRETE |
| 03 30 53 | MISCELLANEOUS CAST-IN-PLACE CONCRETE |
| 07 84 13 | PENETRATION FIRESTOPPING |
| 09 91 13 | EXTERIOR PAINTING |
| 09 91 23 | INTERIOR PAINTING |
| 09 96 00 | HIGH PERFORMANCE COATINGS |

### 1.3 GENERAL REQUIREMENTS:

A. The Contractor shall retain the services of a third party structural engineer currently licensed in the State of Washington to provide hangers, restraint, support, anchoring and seismic calculations and details for all applicable equipment where required by the AHJ.

B. The Contractor shall design supports for equipment, devices and raceways capable of supporting the combined weight of the supported systems and their contents. Anchoring, support and seismic restraint systems shall meet the requirements of applicable Codes with local amendments and the requirements of the Project Structural Engineer and the local AHJ. See the Structural drawings and specifications for requirements.

C. Seismic Performance:
1. The Contractor shall provide seismic support as required by IBC 1613 with local amendments, the local AHJ and the project Structural Engineer.
2. Seismic restraint and hangers and supports systems shall meet the seismic performance requirements of the Project's Structural Engineer

and as per the requirements of Code and the local AHJ. See the Structural drawings and specifications for requirements.

3. The supported equipment and/ or devices will remain in place without any separation and will be fully operational after a seismic event of a strength per Structural and Code/ AHJ requirements.

D. Field Welding shall comply with AWS D1.1/D1.1M and D1.2/D1.2M as applicable.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

F. ESDS-Compliant Products: Inside the building envelope, use materials (including but not limited to adhesives, sealants and solvents) that contain acceptable or lower levels of VOC per referenced standards in Rating System Requirements and no added urea-formaldehyde. Cleaning products used during construction and close-out procedures shall meet Green Seal standards GS-34, GS-37, and SG-40, or the California Code of Regulations, Title 17 Section 94509, VOC standards for cleaning products.

1.4 REQUIREMENTS

A. Provide major equipment components with manufacturer's name, address, catalog number and capacity indicated on a nameplate, securely affixed in a conspicuous place.

B. Protect stored material and equipment against weather, corrosion and dirt. Protect installed electrical, fire alarm and low voltage systems components and equipment against weather damage, corrosion, dirt and construction dust. Seal equipment and conduit where and when necessary to be kept clean and weathertight.

C. Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

D. Provide vibration isolation on all transformers and motor driven equipment provided by the Electrical Contractor.

E. Provide structural work and equipment required for expansion and contraction of conduit. Verify anchors, guides, and expansion joints provide and adequately protect system.

F. Installed hangers, supports and restraints (as applicable) shall have a flame rating of Class 1 and shall be self-extinguishing per ASTM D635 when tested per ASTM 84 requirements unless the requirements of Code or the local Fire Marshal or AHJ are more stringent.

G. Firestop interruptions to fire rated assemblies, materials and components.

H. Firestopping Materials: Provide to achieve fire ratings as noted on architect's drawings for adjacent construction, but not less than 1 hour fire rating. ASTM and UL.
   1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes or otherwise indicated on architectural or structural drawings or specifications.
   2. Surface Burning: UL 723 with maximum flame spread / smoke developed rating of 25/50.
      a. For nonmetallic slotted channel systems and accessories: Comply with ASTM E84. Flame Rating Class 1. Self-extinguishing per ASTM D635.
   3. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 SUBMITTALS:

A. Provide product data for each type of product in Part 2 below. Mark on submittals specific equipment and devices intended for installation on product where multiple equipment and/ or devices are shown on a single catalog page. Include rated capacities and furnished specialties and accessories.
   1. Provide Shop Drawings for specially fabricated seismic restraint and hanger and support systems stamped by an Engineer currently registered in the State of Washington. Include design calculations for hangers and seismic restraints.

B. See Specification Section 26 00 00 "Electrical General Conditions" for additional requirements.

PART 2 PRODUCTS

2.1 HANGERS AND SUPPORTS

A. Manufacturers: Contingent upon meeting requirements of the Project, Code and local AHJ, provide products by one or more of the following:
   1. Allied Tube & Conduit
   2. Cooper B-Line, Inc.
   3. ERICO Global Company; part of Pentair.
   4. Cully-Minerallac Company.
   5. O-Z / Gedney; Emerson Electric Co.
   6. Thomas & Betts Corporation.
   7. Unistrut; a part of atkore International.

B. Metallic Slotted Support Systems
   1. Comply with Metal Framing Manufacturers Association Standard Publication MFMA-4.
   2. Channels:
      a. Channels shall be galvanized steel / stainless steel, Type 304 / stainless steel, Type 316 / 6063-T5 aluminum alloy.

b. Channel widths shall be as required for the applicable load criteria and per requirements of the structural engineer.

3. Fittings and Accessories shall be galvanized steel / stainless steel, Type 304 / stainless steel, Type 316 / 5052-H32 aluminum alloy.
4. Coatings:
   a. Metallic: Hot-dip galvanized after fabrication; applied per MFMA-4 / zinc plated according to ASTM B633.
   b. Painted: Manufacturer's standard painted coating applied per MFMA-4. Protect finishes from damage during shipping.

C. Support Devices for Conduit and Cable:
1. Designed for type and size of conduit / cabling being supported.
2. Material: Steel / Stainless Steel.

D. Support Devices for Conductors in Vertical Conduit:
1. Designed to adequately support the intended cabling plus safety factors without damaging the insulation or reducing the amount of insulation in the area where the cable is supported.
2. Body Material: Malleable iron.

E. Fabricated Metal Supports:
1. Design for weight and dimensions of supported equipment plus safety factor; coordinate with third-party structural engineer as required.
2. Material: Black, Galvanized Structural Steel per ASTM A36/ A36M. Comply with Section 05 50 00 for steel shapes and plates.

F. Components for Mounting, Anchoring and Attachment:
1. Manufacturers: Contingent upon meeting requirements of the Project, Code and local AHJ, provide products by one or more of the following:
   a. Cooper B-Line, Inc
   b. Hilti, Inc.
   c. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
   d. MKT Fastening, LLC.
   e. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   f. Unistrut; a part of atkore International.
2. Provide fasteners listed for use in building material where used and with tension, shear and pullout capacities as required to support intended loads.
3. Coordinate with and receive approval from the Structural Engineer for all locations of Powder-Actuated Fasteners prior to installation.
4. Provided threaded steel hanger rods.
5. Concrete Inserts:
   a. Continuous channel slotted support system.
   b. Universal, malleable iron - Type 18, FS WW-H-171.
6. Provide beam clamps and attachments as required.

## 2.2 VIBRATION AND SEISMIC CONTROLS

A. Vibration Isolators
1. Neoprene Pad Isolators:

2. Where pad-style vibration isolators are used, arrange pads in a single or multiple layers so as to allow for uniform loading over the entire pad area as per the direction of the Architect or Acoustic Consultant. Coordinate dimensions with the equipment to be supported. Pads are to be of a resilient material; exact material to be per the Architect or Acoustic Consultant.
3. Spring isolators shall meet the requirements of the Architect or Acoustic Consultant. Provide seismic or limit-stop restrained spring isolators as required for equipment, local AHJ or the Acoustic Consultant.
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
   b. Color code springs for load carrying capacity.
4. For floor-mounted equipment, provide neoprene bushings intended for use for rigid equipment mountings. Match to type and size of equipment anchor bolts and studs.
5. For wall-mounted equipment, provide neoprene and steel assemblies intended for use for rigid equipment mountings. Match to type and size of anchorage assemblies used.

B. Seismic Controls
1. Manufacturers: Contingent upon meeting requirements of the Project, Code and local AHJ, provide products by one or more of the following:
   a. Cooper B-Line, Inc
   b. Hilti, Inc
   c. Kinetics Noise Control, Inc
   d. Mason Industries, Inc
   e. Unistrut; a part of atkore International
2. Match equipment seismic control restraints and restraint systems to the type and size of the anchor bolts and studs used. Coordinate with Structural Engineer and General Contractor.

## 2.3 SLEEVES AND SLEEVE SEALS

A. Manufacturers: Contingent upon meeting requirements of the Project, Code and local AHJ, provide products by one or more of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. The Metraflex Company.
4. Pipeline Seal and Insulator, Inc.
5. Presealed Systems.
6. Proco Products, Inc.

B. Round tube sleeves for penetrations through Non-Fire-Rated floors and walls: 0.0239-inch thick (minimum) galvanized steel.

C. Rectangular sleeves for penetrations through Non-Fire-Rated floors and walls:
1. Sleeves with a perimeter less than 50 inches and having no side longer than 16 inches: Galvanized steel with minimum thickness of 0.052 inches.
2. All other rectangular sleeves: Galvanized steel with minimum thickness of 0.138 inches.

D. Wall Sleeves for penetrations at exterior walls below grade and exterior floors: Cast iron wall pipe with integral waterstop.

E. Wall sleeves for penetrations at exterior wall penetrations above grade: ASTM A53/A53M Steel pipe sleeves, zinc coated with mechanical sleeve seals.

F. Sleeve seal fittings for conduit penetrations at slab on grade or below grade exterior walls shall be listed and labeled for embedding in concrete slabs or walls in direct contact with earth and shall have plastic or rubber waterstop collars with center gap matching size of conduit to be installed in each penetration.

G. Sealing elements in sleeve seal systems used to fill space between sleeve and raceway for conduit penetrations in slabs on grade or below-grade exterior walls shall be interlocking links of EPDM rubber shaped to fit surface of pipe.

H. Grout shall be non-shrinking and recommended for interior and exterior applications; Grade B, post-hardening and volume-adjusting per ASTM Standard C1107/C1107M.

I. Where permitted by Code, the local AHJ and the Project Architect in Non-Fire-Rated gypsum assemblies silicone sealants may be used to seal penetrations provided they are listed for the intended use and location.
   1. Silicone Sealants are to be of pourable (self-leveling) Grade intended for openings in Non-Fire-Rated horizontal assemblies.
   2. Silicone Foams shall expand and cure in place when mixed, resulting in a flexible, non-shrinking foam.

J. All sealants shall meet the Sustainability requirements of the project. See the General Requirements paragraph of this Specification Section and Division 01 specification for requirements.

K. Size sleeves large enough to allow for movement due to expansion unless manufacturer's instructions or Structural Engineer directs otherwise. Confirm seismic criteria requirements with structural engineer.
   1. At exterior wall and floor penetrations allow for 1 inch of space between raceway and the sleeves for installation of mechanical sleeve seals or sleeve seal systems unless manufacturer's instructions indicate or seismic criteria of project requires otherwise.

## PART 3 EXECUTION

### 3.1 EXISTING WORK

A. Provide access to existing conduit, equipment and other installations remaining active and requiring access.

B. Extend existing cabling and conductor and conduit installations using materials and methods compatible with existing installations.

3.2 SURFACE PREPARATION

A. Examine areas and equipment for conditions that would affect performance of the Work. Proceed with installation only after unsatisfactory conditions have been addressed.

B. Degrease and clean surfaces of any matter that would affect the bond of paint, adhesives or firestopping material.

C. Remove incompatible materials affecting bond of paint, adhesives or firestopping.

D. Degrease and clean surfaces to receive adhesive for identification materials.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

F. For adhesive anchors, clean holes and prepare per manufacturer and Structural Engineer's instructions prior to installation.

3.3 COORDINATION

A. Coordinate the locations of embedded anchors and other connection hardware with equipment attachment points (based on actual equipment to be provided for the project). Locate and avoid the locations of concrete reinforcement, formwork, prestressed tendons, and other embedded items prior to drilling holes.

B. Coordinate the locations of anchors, supports and seismic control assemblies and hardware with equipment mounting points and locations of concrete reinforcement, prestressed tendons, conduit, etc and other embedded items prior to drilling holes. Do not damage existing reinforcing or embedded items.
   1. Notify the structural engineer immediately if any embedded items are encountered during drilling.

C. Prior to drilling holes allow all concrete and masonry to reach full design strength; coordinate with and receive approval from the Architect and Structural Engineer.

3.4 INSTALLATION – CLEARANCE

A. Devices, equipment and control components shall be accessible for inspection, service, repair and replacement.

B. Ensure Code-required clearances are provided at all applicable equipment.

3.5 INSTALLATION – INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying conduit 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, coordinate with General Contractor, Architect and Structural Engineer to drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.6 INSTALLATION – HANGERS AND SUPPORTS

A. Comply with NFPA 70, NECA 1, NECA 101, NECA 102, NECA 105 and NECA 111 for installation and application of hangers and supports for electrical equipment and systems except if requirements in this Section, Manufacturer's written instructions, Structural Engineer or of the AHJ are stricter.

B. Install hangers, supports, anchors, etc per Code and manufacturer and Structural Engineer's instructions.

C. Minimum hanger rod size shall be 1/4-inch (6 mm) in diameter.

D. Space supports as required by NFPA 70.

E. Secure raceways and cables with devices approved for the intended use by an agency acceptable to the AHJ. For conduit 1-1/2-inch (38 mm) and smaller above suspended ceilings, spring-steel clamps designed for supporting single conduits without bolts may be used for fastening conduit to trapeze supports.

F. Size and install support assembly components to meet the present and anticipated future loads with appropriate safety factors. Install hanger rod stiffeners where required to prevent the buckling of hanger rods by seismic forces. Coordinate with structural engineer as required.

G. Size and install trapeze-style support systems where used such that conduit / cabling capacity can be increased by at least 25% in the future. Coordinate with structural engineer as required.

H. Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise required by Code or Architectural or Structural drawings or specifications.
   1. To Wood: Lag screws or Through Bolts.
   2. To New Concrete: Bolt to Concrete Inserts.
   3. To Existing Concrete: Expansion Anchor Fasteners.
   4. To Hollow Masonry: Approved Toggle-type Bolts.
   5. To Solid Masonry: Expansion Anchor Fasteners.
   6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M with lock washers and nuts / Beam Clamps (MSS SP-58, Type 19, 21, 23, 25 or 27) complying with MSS SP-69 / Spring Tension Clamps.
   7. To Light Steel: Sheet Metal Screws.

8. To Hollow Walls and Nonstructural Building Surfaces: Mount on slotted channel racks attached to substrate per seismic restraint and anchorage requirements and per structural engineer.

I. Use:
1. Interior Locations: Zinc-coated steel anchors
2. Exterior Locations: Stainless-steel anchors

J. Holes for expansion anchors shall be drilled to avoid the need for reinforcing bars.

K. Protect anchors from damage during installation.

L. Secure raceways and cabling to trapeze supports in a manner approved by the local AHJ.

M. Installation shall allow for the free movement of equipment within its intended normal mode of operation.

N. Install fabricated metal supports per requirements of Specification Section 05 50 00, “Metal Fabrications.”

## 3.7 INSTALLATION – CONCRETE BASES

A. Concrete bases shall be installed to provide at least 4 inches of base beyond the edges of the equipment supported in both directions unless indicated otherwise on the drawings or unless otherwise required by intended anchoring method.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete unless otherwise required by Architect, Structural Engineer or equipment to be supported.

C. Anchor equipment to concrete base per manufacturer’s written instructions or requirements of Structural Engineer.

## 3.8 INSTALLATION – VIBRATION AND SEISMIC CONTROLS

A. Provide hanger rod stiffeners where required by Code, local AHJ or Structural Engineer.

B. Install vibration and seismic control assemblies and devices per Code, local AHJ, Manufacturer’s written instructions, structural engineer and acoustic consultant.

C. Select and install seismic support assemblies where required to provide adequate strength to carry present and future static and seismic loads within loading limits per the requirements of Code, the local AHJ and the Structural Engineer.

D. Install resilient bushing assemblies for wall-mounted equipment.

E. Install resilient, bolt-isolation washers where the clearance between an anchor and the adjacent surface exceeds 0.125 inch (3.2 mm).

F. Unless otherwise required by Code, the local AHJ or the Structural Engineer, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

G. Install flexible connections in raceway, cable trays, busways, etc where they cross seismic joints, where adjacent sections are supported by different structural elements and where terminating to equipment that is anchored to a different structural element than the one supporting them where they approach said equipment.

H. Installation shall allow for the free movement of equipment within its intended normal mode of operation.

3.9 INSTALLATION – SLEEVES

A. Comply with NFPA 70, NECA 1, NEMA VE2 and the local Building Codes as applicable for installation and application of sleeves and sleeve seals for electrical penetrations except if requirements in this Section, Manufacturer's written instructions, Structural Engineer or of the AHJ are stricter.

B. Exterior watertight entries: Seal with mechanical sleeve seals per manufacturer's recommendations for intended penetrations locations and raceway sizes.
1. Center raceway in sleeve. Install mechanical sleeve seals per manufacturer's instructions to make watertight seal.
2. At roof penetrations, seal individual penetrations with flexible boot-type flashing units unless directed otherwise by Architect or Envelope Consultant. Coordinate installation of flashing with the installation of the roof.

C. Set sleeves in position in and secure to forms as new walls and slabs are constructed. Provide reinforcing around sleeves.
1. Cut sleeves for wall penetrations for mounting flush with both sides of the wall; deburr the sleeves after cutting.
2. Where sleeves are used at floor penetrations, extend the sleeves 2 inches above the finished floor level or as otherwise directed by Architect or Engineer; deburr the sleeves after cutting.

D. At interior Non-Fire-Rated walls and floors comply with the requirements of Section 07 92 00, "Joint Sealants." The space between the sleeve and raceway shall be sealed with joint sealant or compound intended for the specific application, use and location or the joint. The space outside the sleeves is to be sealed with solidly packed mortar or grout such that no voids remain in the sealing material; smooth exposed surfaces.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with insulation and caulk or fireproof airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Protect all sealants while curing.

G. Size sleeves large enough to allow for movement due to expansion unless manufacturer's instructions or Structural Engineer directs otherwise. Confirm seismic criteria requirements with structural engineer.

H. At exterior wall and floor penetrations allow for 1 inch of space between raceway and the sleeves for installation of mechanical sleeve seals or sleeve seal systems unless manufacturer's instructions indicate or seismic criteria of project requires otherwise.

3.10 INSTALLATION – FIRE STOPPING AND SEALS AT NON-FIRE RATED PARTITIONS

A. .

3.11 EXAMINATION AND TESTING

A. Examine anchors and support rough-in work prior to the installation of equipment and raceways to verify actual locations and other conditions potentially affecting the completion of the installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. The Contractor shall test at least five of each type and size of installed anchors and fasteners as selected by the Architect to 90 percent of the rated proof load of the device. If any of the test group of the installed anchors and fasteners fail the testing, all others of the same type installed on the project shall also be tested to 90 percent of the rated proof load of the device.

D. Equipment, devices, anchors, hangers, supports, etc will be considered defective if they do not pass tests and inspections.

E. The Contractor shall provide a test and inspection report summarizing all tests and inspections in this Section, the results or said tests and inspections, what actions were taken to correct any unsatisfactory conditions and devices, and retesting results confirming that any originally deficient installations have been corrected.

3.12 PAINTING

A. See Specification Sections 09 91 13 "Exterior Painting" / 09 91 23 "Interior Painting" / 09 96 00 "High Performance Coatings" for requirements.

B. For galvanized surfaces, after cleaning and preparing surface, apply a galvanizing-repair paint per ASTM A780.

END OF SECTION

SECTION 26 05 19

# LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## 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 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. Mineral-insulated cable, Type MI, rated 600 V or less.
6. Fire-alarm wire and cable.
7. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
1. Section 271313 "Communications Cabling" for twisted pair cabling used for data circuits.

### 1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

B. VFC: Variable-frequency controller.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS:

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, an Atkore Brand.
2. Cerro Wire LLC.
3. Encore Wire Corporation.
4. General Cable Corporation.
5. Southwire Company.

## 2.2 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 B8 or ASTM B496 for stranded conductors.

D. Conductor Insulation:
1. Type USE-2 and Type SE: Comply with UL 854.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type UF: Comply with UL 83 and UL 493.
4. Type XHHW-2: Comply with UL 44.

## 2.3 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 USE-2 and Type SE: Comply with UL 854.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

## 2.4 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 with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors:
1. Feeders and branch circuits smaller than #4 AWG: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
2. Feeders #4 AWG and Larger: Aluminum, complying with ASTM B 800 and ASTM B 801.

E. Ground Conductor: Bare or insulated.

F. Conductor Insulation:
1. For Copper MC Cable: Type THHN/THWN-2: Comply with UL 83.
2. For Aluminum MC Cable: Type XHHW-2: Comply with UL 44.

G. Armor: Aluminum, interlocked.

H. Jacket: PVC applied over armor.

2.5 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 with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors:
1. Feeders and branch circuits smaller than #4 AWG: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
2. Feeders #4 AWG and Larger: Aluminum, complying with ASTM B 800 and ASTM B 801.

E. Ground Conductor: Bare or insulated.

F. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

G. Armor: Aluminum, interlocked.

2.6 MINERAL-INSULATED CABLE, TYPE MI

A. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600 V or less.

B. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:
1. Pentair.
2. Pyrotenax.
3. Watlow Electric Manufacturing.

C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. UL 2196 for fire resistance.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper.

E. Insulation: Compressed magnesium oxide.

F. Sheath: Copper.

2.7 FIRE-ALARM WIRE AND CABLE

A. MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:
1. Allied Wire & Cable, Inc
2. Comtran Corporation.
3. Genesis Cable Products; Honeywell International, Inc
4. Pyrotenax.
5. Superior Essex, Inc.
6. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG or as recommended by system manufacturer].
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.

2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.8 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M; Electrical Products Division.
2. ABB, Electrification Products Division.
3. AFC Cable Systems, Inc.
4. Arlington Industries.
5. Hubbell Power Systems, Inc.
6. O-Z/Gedney; EGS Electrical Group LLC.
7. Thomas & Betts Corporation.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Termination: Compression.

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. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

E. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

F. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2 or XHHW-2, single conductors in raceway installed per Code and AHJ requirements.

B. Exposed Feeders: Type THHN/THWN-2 or Type XHHW-2, single conductors in metallic raceway. For exposed feeders that do not leave the Electrical Rooms and that are not subject to physical damage, the Electrical Contractor may also use Metal-clad cable, Type MC as allowed by Code.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2 or Type XHHW-2, single conductors in raceway or Metal-clad cable, Type MC as allowed by Code.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2 or Type XHHW-2, single conductors in raceway or Metal-clad cable, Type MC as allowed by Code.

F. Feeders in Cable Tray: Cable trays are intended for low voltage systems cabling only; no power conductors or cable are to be installed in the cable tray.

G. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in metallic raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC as allowed by Code.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC as allowed by Code.

K. Branch Circuits in Cable Tray: Cable trays are intended for low voltage systems cabling only; no power conductors or cable are to be installed in the cable tray.

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. The Contractor shall conceal all conduit, cabling and boxes in finished areas unless indicated otherwise or granted specific permission by the Architect. Install all

conduit and cabling perpendicular to or parallel with building lines wherever possible.

B. In open ceiling areas, all cabling shall be installed in conduit. Conduits shall be painted; confirm finish with Architect.

C. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

D. 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.

E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

G. Support cables according to Section 260500, “Common Work Results for Electrical.”

3.4 INSTALLATION OF FIRE-ALARM WIRING

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method:
1. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted other than at open ceiling areas.
3. Signaling Line Circuits: Power-limited fire-alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for su-

pervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function. Confirm requirements with Design-Build Fire Alarm Contractor.

3.5 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 (150 mm) of slack unless otherwise noted on drawings.

D. Comply with requirements in Section 28 46 00 “Addressable Fire-Alarm System” for connecting, terminating, and identifying Fire Alarm System wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "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.

3.7 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 260500.

3.8 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 078413 "Penetration Firestopping."

## 3.9 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 for compliance with requirements:
   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. Continuity test on each conductor and cable.
   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.
   5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

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 260519

SECTION 26 05 26

# GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## 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 grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Foundation steel electrodes.
   3. Ground mesh electrode system.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product in Part 2.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
         1) Test wells.
         2) Ground rods.
         3) Ground rings.
         4) Ground mesh system.
         5) Grounding arrangements and connections for separately derived systems.
      b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, ground mesh system, grounding connections for separately derived systems, based on NETA MTS.
         1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
         2) Include recommended testing intervals.

## 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, unless indicated otherwise on drawings provide products by one of the following:
1. ABB, Electrification Products Division.
2. Burndy; Hubbell Incorporated.
3. ERICO.
4. Harger Lightning & Grounding.
5. ILSCO.
6. O-Z/ Gedney; Emerson Electric, Co.
7. Siemens Industry, Inc.
8. Thomas & Betts Corporation.

### 2.3 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. Unless indicated otherwise on the drawings or otherwise required by Code, provide the following:
   a. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   b. Bonding Conductor: No. 2, solid conductor.
   c. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, sized as required and indicated on drawings, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) 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. See design drawings for additional requirements and information.

### 2.4 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: Non-reversible, high-compression type. Provide two-hole lugs and stainless hardware where indicated on drawings or as required by Code/ Local AHJ.

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. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt or socket set screw.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

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, see drawings for additional requirements.

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 or stainless-steel 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.

## 2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel with 99.9% pure electrolytic copper coating; 5/8 by 96 inches (16 by 2400 mm).

B. Ground Ring: Install a grounding conductor, electrically connected to each ground rod and to each indicated item, extending around the perimeter of building as indicated in the design drawings.

C. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor. See design drawings for required conductor size and additional information.

D. Ground Mesh: #6 AWG copper conductor rated for direct burial in a 12-inch mesh at least 18-inches below grade. See design drawings for additional information and requirements.

## 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 in the drawings or specifications.

B. Underground Grounding Conductors: Install bare copper conductor, size as indicated on drawings.
1. Bury at least 30 inches (750 mm) below grade unless indicated otherwise on drawings or otherwise required by Code.
2. Where conductors come up from concrete or earth, protect conductors with rigid Schedule 40 PVC conduit.

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 on the drawings.
1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) 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. See Grounding System Riser Diagram, drawing E61.01.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator. See Grounding System Riser Diagram, drawing E61.01.

B. Dry-Type Transformers: Ground non-utility transformers per Code requirements. See Grounding System Riser Diagram, drawing E61.01.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Ground all utility infrastructure per Utility requirements.

C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) 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 (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

D. 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.

E. Pad-Mounted Transformers: Ground all utility infrastructure per Utility requirements. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. See E61-series drawings.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

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.

E. Metallic Fences: Comply with requirements of IEEE C2.
   1. Grounding Conductor: Bare copper, as indicated on the design drawings.
   2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
   3. Barbed Wire: Strands shall be bonded to the grounding conductor.

## 3.6 FENCE GROUNDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
   1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
      a. Gates and Other Fence Openings: Ground fence on each side of opening.
         1) Bond metal gates to gate posts.
         2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Grounding Method: See E61-series drawings.

C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

## 3.7 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 (50 mm) 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.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
   1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. 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.

E. 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.

F. 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.

G. Ground Ring: Install a grounding conductor, electrically connected to each ground rod and to each indicated item, extending around the perimeter of area indicated on drawings.
   1. Install tinned-copper conductor as indicated on design drawings.
   2. Bury ground ring as indicated on design drawings.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor, size as indicated on design drawings.
   1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation where in contact with earth.
   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.

I. 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.

3.8 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 the 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.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

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: 5 ohms.
2. Panelboards Serving Electronic Equipment: 1 ohm(s).
3. Pad-Mounted Equipment: 5 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 260526

SECTION 26 05 33

# RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

## 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. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Underground ducts and raceways.
6. Boxes, enclosures, and cabinets.

### 1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

C. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

D. Duct Bank:
1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

E. GRC: Galvanized rigid steel conduit.

F. IMC: Intermediate metal conduit.

G. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

### 1.4 ACTION SUBMITTALS

A. Product Data: For raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
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. Shop Drawings:
1. For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
2. For conduit and raceway support systems, stamped and signed by a Structural Engineer currently registered in the State of Washington.
3. Precast or Factory-Fabricated Underground Utility Structures:
a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design.
e. Include grounding details.
f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
g. Include joint details.
4. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

## 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal 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.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

## 1.6 FIELD CONDITIONS

A. Ground Water: Confirm ground water level with Architect and Civil Engineer.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. CONDUITS AND FITTINGS:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc.
   b. Allied Tube & Conduit; a Tyco International Ltd. Co.
   c. Arlington Industries.
   d. Carlon, by ABB.
   e. Cantex, Inc.
   f. O-Z/Gedney; a brand of EGS Electrical Group.
   g. Prime Conduit, Inc.
   h. Republic Conduit.
   i. Southwire Company
   j. Thomas & Betts Corporation.
   k. Western Tube and Conduit Corporation.
   l. Wheatland Tube Company; a division of John Maneely Company.

B. METAL WIREWAYS AND AUXILIARY GUTTERS:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper B-Line, Inc.
   b. Hoffman; a Pentair company.
   c. Mono-Systems, Inc.
   d. Square D; a brand of Schneider Electric.

C. SURFACE RACEWAYS
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated.
   b. MonoSystems, Ins.
   c. Wiremold/ Legrand.

D. BOXES, ENCLOSURES AND CABINETS:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlon, by ABB.
   b. Cooper Technologies Company; Cooper Crouse-Hinds.
   c. EGS/Appleton Electric.
   d. Hoffman; a Pentair company.
   e. Hubbell Incorporated; Killark Division.
   f. Milbank Manufacturing Co.
   g. Mono-Systems, Inc.
   h. O-Z/Gedney; a brand of EGS Electrical Group.
   i. RACO; a Hubbell Company.
   j. Thomas & Betts Corporation.
   k. Wiremold / Legrand.

E. DUCT ACCESSORIES:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Allied Tube & Conduit; a Tyco International Ltd. Co.
b. Cantex, Inc.
c. Carlon, by ABB
d. Kraloy Fittings.

F. PRECAST CONCRETE HANDHOLES AND BOXES:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. H2 Pre-Cast Inc.
b. Oldcastle Infrastructure.

G. POLYMER CONCRETE AND FIBERGLASS HANDHOLES AND BOXES:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. MacLean Highline.
b. Oldcastle Infrastructure.
c. Quazite; Hubbell Incorporate.

2.2 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 (1 mm), 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 or die cast.
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 (1 mm), 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.

## 2.3 NONMETALLIC CONDUITS AND FITTINGS

A. 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.

B. All infrastructure for Utilities (power and telecom) are to be provided and installed per the requirements of each Utility.

C. Nonmetallic Conduit:
1. Fiberglass:
   a. Comply with NEMA TC 14.
   b. Comply with UL 2515 for aboveground raceways.
   c. Comply with UL 2420 for belowground raceways.
2. ENT: Comply with NEMA TC 13 and UL 1653.
3. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated or required by utility service provider.
4. LFNC: Comply with UL 1660.
5. Rigid HDPE: Comply with UL 651A.
6. Continuous HDPE: Comply with UL 651A.
7. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.
8. RTRC: Comply with UL 2515A and NEMA TC 14.

D. 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.

E. 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.

F. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.4 FLEXIBLE NONMETALLIC DUCTS

A. HDPE Duct: Type EPEC-40 HDPE, complying with NEMA TC 7 and UL 651A.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.5 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 260553 "Identification for Electrical Systems."

2.6 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated or required by Code, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be Type 3R and 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: Screw-cover type unless otherwise indicated or required by Code.

D. Finish: Manufacturer's standard enamel finish.

2.7 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways 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. Manufacturer's standard enamel finish in color selected by Architect.

2.8 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, ferrous alloy or 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. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. 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. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes:
1. Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
2. All luminaire outlet boxes in the ceiling of habitable rooms of dwelling occupancies shall be listed for the sole support of ceiling-suspended (paddle) fans as required by 314.27(C) in the National Electrical Code.

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, cast aluminum or 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: As required for installation of intended device.

L. Gangable boxes are allowed.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
3. Where accessible by the residents and/ or the general public, provide tamper resistant hardware.

N. Cabinets:
1. NEMA 250, Type 1 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.
7. Where accessible by the residents and/ or the general public, provide tamper resistant hardware.

2.9 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 steel frame, with steel 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."

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 as required by utility service provider.
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.
1. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
2. Knockout panels shall be located no less than 6 inches (150 mm) 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 (38 to 50 mm) thick.

I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.10 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 or Green as per Architect.

D. Configuration: Units shall be designed for flush burial and have open 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. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.11 FIBERGLASS HANDHOLES AND BOXES

A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of hot-dip galvanized-steel diamond plate.

B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

C. Color: Gray or Green as per Architect.

D. First option in "Configuration" Paragraph below facilitates bottom duct entry. Second option may be provided by a separate slab placed in the excavation under an open-bottom enclosure; third option is obtained by molding or fabricating the bottom integrally with the body of the unit.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC" or “TELECOM” as applicable.

I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.12 UTILITY STRUCTURE ACCESSORIES

A. Test and inspect precast concrete utility structures according to ASTM C1037.

B. Provide and install per Utility requirements.

C. 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. 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.
2. 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-40-PVC unless otherwise required by utility service provider.
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.
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 damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) 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 or cast-metal fittings. Compression style fitting are not allowed. 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. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, installed per Electrical Utility Company requirements.

B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

D. Bored Underground Duct: Type EPEC-80-HDPE unless otherwise indicated.

E. Underground Ducts Crossing Driveways and Roadways: Type EPC-40 PVC RNC, encased in reinforced concrete.

F. Stub-ups: Galvanized rigid steel unless required otherwise by the Utility.

G. Bends: Galvanized rigid steel unless required otherwise by the Utility.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Non-Utility Handholes and Boxes for 600 V and Less:
1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
5. Cover design load shall not exceed the design load of the handhole or box.
6. Provide tamper resistant hardware.

## 3.4 ABOVE GROUND RACEWAY INSTALLATION

A. Comply with requirements in Section 260500 "Common Work Results for Electrical" 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 (150 mm) 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. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

I. 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.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) 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 (3-m) 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 (50 mm) 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 unless otherwise required by Code.

M. Stub-Ups to Above Recessed Ceilings:
1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. 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.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. 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 (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

S. 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.

T. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

V. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) 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.

W. 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.

X. 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.

Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
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 (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) 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 (0.06 mm per meter of length of straight run per deg C) 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 (0.0115 mm per meter of length of straight run per deg C) 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.

AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) 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.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

CC. 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.

DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

EE. Locate boxes so that cover or plate will not span different building finishes.

FF. 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.

GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

HH. Set metal floor boxes level and flush with finished floor surface.

II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

## 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 260544 "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 078413 "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.

## 3.8 UNDERGROUND DUCTS AND RACEWAYS 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 according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

## 3.9 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete; confirm requirements with General Contractor.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to "Cutting and Patching" Article in Section 017300 "Execution."

## 3.10 DUCT AND DUCT-BANK INSTALLATION

A. Install duct, spacers, and accessories into the duct-bank configuration per Code and/ or Utility requirements. Duct installation requirements in this Section also apply to duct bank.

B. For electrical-power duct bank, note that ampacity of cables may be reduced in duct bank of more than two tiers of two ducts each.

C. Install duct according to NEMA TCB 2.

D. 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.

E. 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 (1200 mm) for utility service ducts, both horizontally and vertically, at other locations unless otherwise indicated.
   1. Duct shall have maximum of three 90-degree bends or the total of all bends shall be no more 270 degrees between pull points.

F. 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.

G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) 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 (19 mm).
   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 (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to terminator spacing 10 feet (3 m) 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 (19 mm).

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) 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.

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 (1.03-MPa) hydrostatic pressure.

K. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.

L. Direct-Buried Duct and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
4. Depth: Install top of duct at least 36 inches (900 mm) 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: Install spacers per Utility Service Provider requirements. Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) 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. Maintain clearances required by utility service providers.
9. Elbows: Provide and install per requirements of utility service providers.
10. 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 (100 mm) 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 312000 "Earth Moving" for installation of backfill materials.

M. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

## 3.11 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. 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 (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Install handholes with bottom below frost line.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators**,** as required by the utility service providers

D. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

## 3.12 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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. First paragraph below requires Contractor to select hardware to install and support cable. If required, revise paragraph to refer Contractor to Drawings, and indicate on Drawings specific requirements for each enclosure.

F. 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.

G. 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.

## 3.13 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

## 3.14 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- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
   3. Test and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

## 3.15 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 260533

SECTION 26 05 53

# IDENTIFICATION FOR ELECTRICAL SYSTEMS

## 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. 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.

### 1.3 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. Delegated-Design Submittal: For fault-current/ short-circuit and arc-flash hazard studies.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2 as applicable.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 260573 "Electrical Systems Studies" requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), 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 circuits.

B. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
   1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Colors for 240-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
   4. Colors for 480/277-V Circuits:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
   5. Color for Neutral: White or gray.
   6. Color for Equipment Grounds: Bare copper, Green or Green with a yellow stripe.

C. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Per Electrical Utility Company requirements.

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. Bond Reference Warning: “"BOND REFERENCE FOR PORTABLE GENERATOR IS THE PERMANENTLY-INSTALLED GENERATOR BOND. DO NOT DISCONNECT PERMANENT GENERATOR OR NEUTRAL BOND AT PERMANENT GENERATOR."
   3. Workspace Clearance Warning: "WARNING – CODE REQUIREMENT - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 42 INCHES (915 MM)."

F. Equipment Identification Labels:
   1. Black letters on a white field.

2.3 LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Hellermann Tyton.
   3. Marking Services, Inc.
   4. Panduit Corp.
   5. Seton Identification Products.

B. 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.

C. 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.

D. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester or 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.

E. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) 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 (37 by 150 mm) for raceway and conductors.
      b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
      c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Hellermann Tyton.
   3. Marking Services, Inc.
   4. Panduit Corp.

B. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

C. 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 (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carlton Industries, LP.
2. Hellermann Tyton.
3. Marking Services, Inc.
4. Panduit Corp.
5. Seton Identification Products.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

D. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

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. Feeder and Branch Circuits 600V and Less:
a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with “Electric” compounded for direct-burial service.

b. Width: 3 inches (75 mm).
c. Overall Thickness: 5 mils (0.125 mm).
d. Foil Core Thickness: 0.35 mil (0.00889 mm).
e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
f. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

4. Electrical Utility Service Warning Tape:
   a. Provide as per utility service requirements.
   b. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   c. Width: 3 inches (75 mm).
   d. Overall Thickness: 8 mils (0.2 mm).
   e. Foil Core Thickness: 0.35 mil (0.00889 mm).
   f. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
   g. Tensile according to ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

## 2.6 TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Carlton Industries, LP.
   3. Marking Services, Inc.
   4. Panduit Corp.
   5. Seton Identification Products.

B. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

C. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch (0.38 mm) thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

D. Write-on Tags:
   1. Polyester Tags: 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
   2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer. Writing on tag must be clearly legible.

## 2.7 SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.

2. Carlton Industries, LP.
3. Champion America.
4. Emedco.
5. Marking Services, Inc.

B. Baked-Enamel Signs:
1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

C. Metal-Backed Butyrate Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches (250 by 360 mm).

D. Laminated Acrylic or Melamine Plastic Signs:
1. Engraved legend.
2. Thickness:
a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
c. Engraved legend with black letters on white face for instructional signs, white letters on a dark gray or black background for identification signs.
d. Self-adhesive.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. Carlton Industries, LP.
3. Champion America.
4. Emedco.
5. Marking Services, Inc.

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 (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
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: Per utility service provider requirements.

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- (10-mm-) high letters for emergency instructions at equipment used for power transfer; including the automatic transfer switch, permanent generator, portable generator docking station, and UPS equipment.

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- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) 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 (150 mm) 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. 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 (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.
   2. Install underground-line warning tape for cables in raceways.

W. Metal Tags:
   1. Place in a location with high visibility and accessibility.
   2. Secure using General purpose cable ties except where Code requires plenum rated cable ties.

X. Nonmetallic Preprinted Tags:
   1. Place in a location with high visibility and accessibility.
   2. Secure using General purpose cable ties except where Code requires plenum rated cable ties.

Y. Write-on Tags:
   1. Place in a location with high visibility and accessibility.
   2. Secure using General purpose cable ties except where Code requires plenum rated cable ties.

Z. 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- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

AA. 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- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

BB. 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- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

DD. Cable ties are not to be used to secure conduits or cabling of the electrical or low voltage systems.

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 30 A and 120V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

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. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels, snap-around color-coding bands or self-adhesive vinyl tape] to identify the phases.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) 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 and circuit.

I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl 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. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels, Baked-enamel warning signs or Metal-backed, butyrate warning signs.
   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.
      c. Dispatch Room Consoles.
      d. Mechanical equipment served by multiple circuit connections.

M. Arc Flash Warning Labeling: Self-adhesive labels.

N. Operating Instruction Signs: [Self-adhesive labels] [Baked-enamel warning signs] [Metal-backed, butyrate warning signs] [Laminated acrylic or melamine plastic signs].

O. Emergency Operating Instruction Signs: Self-adhesive labels, Baked-enamel warning signs, Metal-backed, butyrate warning signs or Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at:
   1. Equipment used for power transfer.
   2. Portable generator docking station.
   3. Permanent generator.
   4. UPS equipment.

P. Equipment Identification Labels:
   1. Indoor Equipment: Baked-enamel signs or Laminated acrylic or melamine plastic signs.
   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. Switchboards.
e. Distribution boards.
f. Current Transformer enclosure.
g. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
h. Emergency system boxes and enclosures.
i. Enclosed switches.
j. Enclosed circuit breakers.
k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Power-transfer equipment.
o. Contactors.
p. Remote-controlled switches and control devices.
q. Battery-inverter units.
r. Monitoring and control equipment.
s. UPS equipment.
t. Permanent Generator.
u. Portable Generator Docking Station.

END OF SECTION 260553

# SECTION 26 09 23

# LIGHTING CONTROL DEVICES

## 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. Indoor occupancy and vacancy sensors.
2. Daylight Harvesting Dimming Controls
3. Digital timer light switches.
4. Lighting contactors.
5. Emergency shunt relays.
6. Lighting Control Panel.

B. Related Requirements:
1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Show installation details for the following:
a. Occupancy sensors.
b. Vacancy sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

### 1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranties.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

### 1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Faulty operation of lighting control software.
   b. Faulty operation of lighting control devices.
2. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

A. All lighting control equipment and devices are to be hard-wired. Wireless devices are not allowed on the project.

### 2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
   1. Acuity Lighting.
   2. Eaton Lighting.
   3. Leviton Mfg. Company, Inc.
   4. Lutron.
   5. Wattstopper.

B. General Requirements for Sensors:
   1. See lighting plans for mountings and types (low voltage, line voltage).
   2. Dual technology.
   3. Hardwired connection.
   4. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Dual-Technology Type: Detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted 48 inches (1200 mm) above finished floor.

## 2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
   1. Acuity Lighting.
   2. Eaton Lighting.
   3. Leviton Mfg. Company, Inc.
   4. Lutron.
   5. Wattstopper.

B. General Requirements for Sensors:
   1. See lighting plans for mountings.
   2. Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed. Lights shall dim to off if adequate daylight is present in the space.
   3. Hardwired connection.
   4. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   5. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

## 2.4 TIMER LIGHT SWITCH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
   1. Acuity Lighting.
   2. Eaton Lighting.
   3. Intermatic.
   4. Leviton Mfg. Company, Inc.
   5. Lutron.
   6. Wattstopper

B. Description: Combination timer and conventional switch lighting control unit. Switchbox-mounted with selectable time interval in 10 minute increments.
   1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for LED, and 1/4 horsepower at 120-V ac.
   2. Integral relay for connection to BAS.
   3. Voltage: Match the circuit voltage.
   4. Color: Per Architect
   5. Faceplate: Color matched to switch.

## 2.5 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
   1. Acuity Lighting.

2. Eaton Lighting.
3. Leviton Mfg. Company, Inc.
4. Lutron.
5. Wattstopper

B. Description: Complying with UL 924.

2.6 LIGHTING CONTROL PANEL

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or pre-approved equal:
1. Acuity Lighting.
2. Cooper Lighting Controls.
3. Lutron.
4. Wattstopper

B. Lighting control panel shall be UL 924 Listed as required for control of emergency lighting circuits.

C. The lighting control panel shall be able to be barriered into multiple sections; see lighting control panel schedule in the design drawings.

D. See lighting plans for additional information and requirements.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

## 3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections. Replace all defective lighting control devices and retest.

C. Prepare test and inspection reports.

## 3.7 COMMISSIONING

A. After the factory-authorized service representative has completed start-up for all of the lighting control devices and systems, the Contractor shall arrange for the factory-authorized service representative to test the system with the Commissioning Agent.

B. The Contractor shall provide completed start-up forms and checklists to the Engineer and Commissioning Agent for all lighting and receptacle control systems and equipment.

C. The Contractor shall coordinate with the Owner, Architect and General Contractor; tests should be performed in the presence of the Owner, Commissioning Agent and Architect unless given specific permission otherwise in writing.

D. The factory-authorized service representative shall coordinate the commissioning of the lighting and receptacle controls with the Commissioning Agent per the Commissioning Plan. This shall include functional testing of:
   1. All daylighting controls.
   2. All occupancy and vacancy sensor.
   3. All manual controls.
   4. The lighting control panel scheduled dimming of corridor luminaires at night as indicated in the design documents, including manual override controls.
   5. All exterior lighting controls; dusk to dawn and dusk to curfew fixtures.
   6. Receptacle controls.

E. It is the responsibility of the Contractor and factory-authorized service representative to re-adjust or replace all equipment and devices that are not operating within the require parameters.

F. The Commissioning Agent will generate a Commissioning report summarizing the Commissioning process. The Contractor shall assist and provide documentation as required to complete this report.

3.8 ADJUSTING

A. Light Level Setting: The Contractor and factory-authorized service representative shall schedule with the Architect and Engineer a time to review and adjust the settings of initial luminaire output levels of the Entry Vestibule 101A, the exterior wall grazers (Type W8) and the exterior uplights at the east entry (Type W9). Review of the exterior luminaires shall occur after sunset.

B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.
   1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
   2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.9 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices and the lighting and receptacle control systems.

B. The factory-authorized service representative shall provide at least 3 hours of training for the Owner’s maintenance personnel.

END OF SECTION 260923

SECTION 26 24 13

PANELBOARDS, SWITCHBOARDS AND TERMINATION CABINET

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. Switchboards.
   2. Distribution panelboards.
   3. Lighting and appliance branch-circuit panelboards.
   4. Load Centers.
   5. Termination Cabinet.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of switchboard and panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switchboard, panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of switchboards, panelboards and overcurrent protective devices.
   6. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
   7. Detail utility company's metering provisions with indication of approval by utility company.
   8. Include evidence of NRTL listing for series rating of installed devices.
   9. Include evidence of NRTL listing for SPD as installed in panelboard.
   10. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   11. Include wiring diagrams for power, signal, and control wiring.
   12. Key interlock scheme drawing and sequence of operations.
   13. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

C. DELEGATED DESIGN SUBMITTALS
   1. For available fault current / short circuit calculations, OCP coordination study, and arc-flash hazard analysis.
   2. For arc-flash labels.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

B. Seismic Qualification Data: Certificates, for switchboards, panelboards, overcurrent protective devices, 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.

C. Field Testing Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards, panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Routine maintenance requirements for switchboards and all installed components.
   2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   3. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.
   2. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
   3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Manufacturer Qualifications: ISO 9001 or 9002 certified.

C. Testing Agency Qualifications: Accredited by NETA.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and panelboards; install temporary electric heating (250 W per switchboard section or panelboard) to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400**.**

D. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:
   1. Do not deliver or install switchboards or panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
      b. Altitude: Not exceeding 6600 feet (2000 m).

1.11 COORDINATION

A. Coordinate layout and installation of switchboards, panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period:
   1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

C. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 SWITCHBOARD AND PANELBOARD COMMON REQUIREMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. General Electric by ABB.
   2. Eaton Corporation; Cutler-Hammer Products.
   3. Siemens Energy & Automation, Inc.
   4. Square D.

B. Source Limitations: Obtain switchboards, panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards and panelboards including clearances between equipment and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

F. Nominal System Voltage: See single-line diagrams.

G. Equipment ratings: See single-line diagrams.

### 2.2 SWITCHBOARD REQUIREMENTS

A. Comply with NEMA PB 2.

B. Comply with UL 891.

C. Front-Connected, Front-Accessible Switchboards:
   1. Main Devices: Panel or Fixed, individually mounted per Code and manufacturer requirements.
   2. Branch Devices: Panel mounted.
   3. Sections front and rear aligned.

D. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Indoor Enclosures: Steel, NEMA 250, Type 1.

F. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

G. Barriers: Between adjacent switchboard sections as required by Code or otherwise indicated on the single-line diagrams.

H. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
   1. Where multiple service disconnecting means are to be located in one switchboard, each service disconnecting means will be located in a separated vertical switchboard section with barriers separating each vertical switchboard section per NEC 230.71.
   2. NRTL Label: Where indicated on the single-line diagram as service entrance rated, equipment shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

I. Utility Metering Compartment: Provide per Code and Utility requirements.

J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

K. Buses and Connections: Three phase, four wire unless otherwise indicated.
   1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
   2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
   3. Tin-plated aluminum feeder circuit-breaker line connections.
   4. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
   5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
   6. Disconnect Links:
      a. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
   7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
   8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

L. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

M. Pull Box on Top of Switchboard: As per project requirements/ Contractor decision:
   1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
   2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
   3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
   4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

N. Short-Circuit Current Rating: Series rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
   1. Switchboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as required by the Contractor’s Short Circuit Study or 14,000 A rms symmetrical, whichever is greater.

## 2.3 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Comply with NEMA PB 1.

C. Enclosures: Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   2. Height: 84 inches (2.13 m) maximum.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.

D. Incoming Mains:
   1. Location: Per Contractor.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

E. Phase, Neutral, and Ground Buses:
   1. Material: Tin-plated aluminum.
      a. Plating shall run entire length of bus.
      b. Bus shall be fully rated the entire length.
   2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
   5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
   6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. NRTL Label: Where indicated on the single-line diagram as service entrance rated, equipment shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

H. Short-Circuit Current Rating: Series rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
   1. Panelboards/ load centers and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as required by the Contractor's Short Circuit Study or 10,000 A rms symmetrical, whichever is greater.
   2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as required by the Contractor's Short Circuit Study or 14,000 A rms symmetrical, whichever is greater.

2.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards, Panelboards and load centers shall withstand the effects of earthquake motions determined according to local AHJ requirements and the Project Structural Engineer.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will remain operational."

2.5 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: Circuit breaker or Lugs only as indicated on drawings.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.6 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or Lugs only as indicated on drawings.

C. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior.

Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.7 LOAD CENTERS

A. Load Centers: Comply with UL 67.

B. Mains: Circuit breaker or Lugs only as indicated on drawings.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges secured with flush latch.

E. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.8 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic Trip Circuit Breakers:
      a. RMS sensing.
      b. Field-replaceable rating plug or electronic trip.
      c. Digital display of settings, trip targets, and indicated metering displays.
      d. Multi-button keypad to access programmable functions and monitored data.
      e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
      f. Integral test jack for connection to portable test set or laptop computer.
      g. Field-Adjustable Settings:
         1) Instantaneous trip.
         2) Long- and short-time pickup levels.
         3) Long and short time adjustments.
         4) Ground-fault pickup level, time delay, and I squared T response.
   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Panelboard Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    d. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    f. Multipole units enclosed in a single housing with a single handle or factory assembled to operate as a single unit.
    g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    h. Shunt Trip: 120-V trip coil energized from separate circuit.

B. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
1. Two-step, stored-energy closing.
2. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
    a. Instantaneous trip.
    b. Time adjustments for long- and short-time pickup.
    c. Ground-fault pickup level, time delay, and I squared t response.
3. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
4. Remote trip indication and control.

C. Fused Switch (only where shown on Contract Drawings set): NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

## 2.9 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
   1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.10 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

2.11 TERMINATION CABINET REQUIREMENTS

A. Termination Cabinet to meet requirements of Seattle City Light (SCL), including but not limited to SCL Standard 0230.03.

B. Manufacturer: Subject to SCL requirements, provide equipment by Skyline Electric & MFG Co or a pre-approve equal accepted by SCL. Contractor to provide proof of SCL acceptance with substitution request form.

C. General Requirements for Termination Cabinet:
   1. UL Listed, NEMA 3R pad-mounted cabinet with lockable doors.
   2. Conform to all SCL requirements.
   3. Bus bars to be located at tops of cabinet, drilled per SCL Standard 0474.08 and run from front to back.
   4. No mullion to be provided between the doors. The doors shall meet up when shut, shut that they are lockable with only one utility padlock.
   5. See Contract Drawings for additional information and requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store switchboards and panelboards according to NECA 400 and NECA 407.

1. Lift or move with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished with switchboard.

C. Protect from moisture, dust, dirt, and debris during storage and installation.

D. Examine switchboards and panelboards before installation. Reject switchboards and panelboards that are damaged, rusted, or have been subjected to water saturation.

E. Examine elements and surfaces to receive switchboards and panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of switchboards and panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install switchboards and accessories according to NECA 400.

D. Install panelboards and accessories according to NECA 407.

E. Install termination cabinet and accessories per SCL Requirements and Manufacturer’s Instructions.

F. Equipment Mounting - Switchboard: Where shown on design drawings, install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete" and/ or Section 033053 "Miscellaneous Cast-in-Place Concrete."
1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

G. Equipment Mounting - Panelboards:

1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
2. Comply with requirements for seismic control devices as required by the local AHJ and Project Structural Engineer.

H. Equipment Mounting – Termination Cabinet: Install termination cabinet on a concrete base per SCL requirements. Anchor per Manufacturer Instructions and SCL requirements.

I. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from equipment.

J. Comply with mounting and anchoring requirements as required by the local AHJ and Project Structural Engineer.

K. Mount such that the top-most circuit breaker is not higher than 79-inches above finished floor as required by Code.

L. Mount panelboard cabinet plumb and rigid without distortion of box.

M. Mount surface-mounted panelboards to steel slotted supports1 1/4 inch (32 mm) in depth. Orient steel slotted supports vertically.

N. Install overcurrent protective devices, controllers and instrumentation not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

O. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

P. Install filler plates in unused spaces.

Q. Install filler plates in unused spaces of panel-mounted sections.

3.3 CONNECTIONS

A. As required by Code, bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

B. Support and secure conductors within the switchboard according to NFPA 70.

C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards or panelboards with one or more service disconnecting and overcurrent protective devices.

B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

C. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
   1. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
   1. Create a directory to indicate installed Panelboard circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Panelboards and Switchboards:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Coordinate tests and inspections of the Termination Cabinet with SCL.

D. Switchboards, Panelboards and the Termination Cabinet will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.7 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain panelboards, switchboards, termination cabinet, overcurrent protective devices, instrumentation, and accessories.

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 electricity metering and work to accommodate utility company revenue meters.

### 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.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Meter data sheet for each meter.

### 1.6 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.

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.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. General Electric by ABB EPIS.
   2. Eaton Corporation; Cutler-Hammer Products.
   3. Milbank Manufacturing.
   4. Siemens Energy & Automation, Inc.
   5. Square D; a brand of Schneider Electric USA, Inc.

B. Provide and install utility metering infrastructure per the requirements of the utility company.

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.
   3. Meter Socket Rating: Coordinated with connected feeder circuit rating.
   4.

E. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, meter socket modules, and feeder circuit breakers arranged in adjacent vertical sections complete with interconnecting buses.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABB EPIS (formerly General Electric).
      b. Eaton Corporation; Cutler-Hammer Products.

c. Siemens Energy & Automation, Inc.
d. Square D.

2. Comply with requirements of utility company for meter centers.
3. Comply with UL 67.
4. Housing: NEMA 250, Type 3R enclosure.
5. Minimum Short-Circuit Rating: As per Contractor's Short Circuit/ Fault Current calculations.
6. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers and having an adjustable magnetic trip setting for circuit-breaker frame sizes of 250 A and larger. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers." Circuit breakers shall be operable from outside the enclosure to disconnect the unit. Configure cover so it can be opened only when the disconnect switch is open.
7. Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect downstream circuit breakers and to house load centers and panelboards that have 10,000A interrupting capacity.
8. Identification: Complying with requirements in Section 260553 "Identification for Electrical Systems."
9. Physical Protection: Tamper resistant, with hasp for padlock.
10. Surge Protection for Main Disconnect: Factory installed, integrally mounted, UL 1449 Type 1. Comply with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
11. Surge Protection at Main Disconnect: Field-mounted external to the device, UL 1449 Type 2, with integral disconnect and overcurrent protective device. Comply with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
12. Surge Protection at Main Terminal Box: Factory installed, integrally mounted, UL 1449 Type 1. Comply with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
13. Surge Protection at Main Terminal Box: Field-mounted external to the device, UL 1449 Type 2, with integral disconnect and overcurrent protective device. Comply with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

F. Arc-Flash Warning Labels;
1. Labels: Comply with requirements for "Arc-Flash Warning Labels" in Section 260573 "Electrical Systems Studies." Apply a 3-1/2-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install raceways, meter socket, CT cabinets 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 arc-flash labels as required by NFPA 70.

D. Wiring Method:
1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Minimum conduit size shall be 1/2 inch (13 mm) unless larger size required by utility company.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Coordinate with utility company to perform tests and inspections.

B. Tests and Inspections:
1. Equipment and Software Setup:
a. Set meter date and time clock.
b. Test, calibrate, and connect pulse metering system.
c. Set and verify reporting demand interval for demand meters.
d. Report settings and calibration results.
e. Set up reporting software.
2. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
3. Turn off circuits supplied by metered feeder and secure them in off condition.
4. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
5. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
6. Generate test report for each tenant or activity from the meter reading tests.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

END OF SECTION

# SECTION 26 27 26

# WIRING DEVICES

## 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. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Twist-locking receptacles.
5. Pendant cord-connector devices.
6. Toggle switches, 120/277 V, 20 A.
7. Occupancy sensors.
8. Wall plates.
9. Floor service fittings.
10. Prefabricated multioutlet assemblies.

### 1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Manufacturers: Subject to compliance with requirements, for the following Sections provide products from one of the following:
   1. Cooper Wiring Devices: Division of Cooper Industries, Inc.
   2. Hubbell Incorporated.
   3. Leviton Mfg. Company, Inc.
   4. Pass & Seymour; Legrand North America, LLC.

B. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Comply with NFPA 70.

D. RoHS compliant.

E. Comply with NEMA WD 1.

F. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with requirements in this Section.

G. Devices for Owner-Furnished Equipment:
   1. Receptacles: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

H. Device Color:
   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
   2. Wiring Devices Connected to UPS System: Gray or as selected by Architect.

I. Wall Plate Color: For plastic covers, as selected by Architect.

J. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL PURPOSE RECEPTACLES, INTERIOR LOCATIONS:

A. In all Dwelling Units, provide 125V, 15A, Tamper-Resistant receptacles unless otherwise required by Code, equipment to be connected, or the Contract Documents. Provide GFCI type receptacles or GFCI type breakers where GFCI protection is required; see Contract Drawings.

B. In Common areas of multifamily buildings, provide 125V, 20A, Tamper-Resistant receptacles unless otherwise required by Code, equipment to be connected, or the Contract Documents. Provide GFCI type receptacles or GFCI type breakers where GFCI protection is required; see Contract Drawings.

C. In MEP equipment rooms and other areas of multifamily buildings not accessible to residents, provide 125V, 20A receptacles unless otherwise required by Code, equipment to be connected, or the Contract Documents. Provide GFCI type receptacles or GFCI type breakers where GFCI protection is required; see Contract Drawings.

D. Provide 125V, 20A, receptacles unless otherwise required by Code, equipment to be connected, or the Contract Documents. Provide GFCI type receptacles or GFCI type breakers where GFCI protection is required; see Contract Drawings.

E. See Contract Drawings for requirements and locations for controlled receptacles.

F. Provide specialty type receptacles as required for appliances/ equipment and/ or as indicated on the drawings.

2.3 GENERAL PURPOSE RECEPTACLES, EXTERIOR LOCATIONS:

A. At exterior dwelling unit patios, decks, exterior entrances to units, etc provide 125V, 15A, Tamper-Resistant, weather resistant, GFCI-type receptacles in weatherproof while in use enclosures unless otherwise required by Code, equipment to be connected, or the Contract Documents.

B. For all other exterior areas of multifamily buildings, provide 125V, 20A, Tamper-Resistant, weather resistant, GFCI-type receptacles in weatherproof while in use enclosures unless otherwise required by Code, equipment to be connected, or the Contract Documents.

C. For all exterior areas of provide 125V, 20A, Tamper-Resistant, weather resistant, GFCI-type receptacles in weatherproof while in use enclosures unless otherwise required by Code, equipment to be connected, or the Contract Documents.

D. Provide specialty type receptacles as required for appliances/ equipment and/ or as indicated on the drawings.

2.4 STANDARD-GRADE RECEPTACLES, 125 V, 15 A AND 20 A

A. Duplex Receptacles, 125 V, 20 A
   1. Description: Two pole, three wire, and self-grounding.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 15 A and 20 A
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
   2. Configuration: NEMA WD 6, Configuration 5-15R or 5-20R.

3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.5 GFCI RECEPTACLES, 125 V, 15A AND 20 A

A. Duplex GFCI Receptacles, 125 V, 15A and 20 A
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-15R or 5-20R.
3. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Weather-Resistant, GFCI Duplex Receptacles, 125 V, 15A and 20 A
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R or 5-20R.
3. Standards: Comply with UL 498 and UL 943 Class A.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

C. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 15 A and 20A
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-15R or 5-20R.
3. Type: Feed through as allowed by Code and project requirements.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

D. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 15 A and 20A
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R or 5-20R.
3. Type: Feed through as allowed by Code and project requirements.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.6 USB RECEPTACLES

A. USB Charging Receptacles

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
3. Standards: Comply with UL 1310 and USB 3.0 devices.
4. Provide receptacles listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" where noted on drawings.

2.7 TWIST-LOCKING RECEPTACLES

A. Configuration: NEMA WD 6, See Power Plans for Configuration.

B. Standards: Comply with UL 498.

2.8 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.

B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.

C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

D. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

E. Standards: Comply with FS W-C-596.

2.9 CORD AND PLUG SETS

A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A
1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20
1. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A
1. Comply with UL 20 and FS W-S-896.

D. Pilot-Light, Single-Pole Switches: 120/277 V, 20 A
   1. Description: Illuminated when switch is off.
   2. Standards: Comply with UL 20 and FS W-S-896.

E. Lighted Single-Pole Switches, 120/277 V, 20 A
   1. Description: Handle illuminated when switch is off.
   2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

F. Key-Operated, Single-Pole Switches, 120/277 V, 20 A
   1. Description: Factory-supplied key in lieu of switch handle.
   2. Standards: Comply with UL 20 and FS W-S-896.

G. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A
   1. Description: For use with mechanically held lighting contactors.
   2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

H. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A
   1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
   2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

## 2.11 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology
   1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
   2. Standards: Comply with UL 20.
   3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
   4. Adjustable time delay of 15 or 30 minutes as indicated on drawings.
   5. Able to be set to Automatic or Manual-On mode as indicated on drawings.
   6. Connections: Hard wired.

## 2.12 TIMER LIGHT SWITCH

A. Digital Timer Light Switch
   1. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.
   2. Standards: Comply with UL 20.
   3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
   4. Integral relay for connection to BAS.

## 2.13 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.14 FLOOR SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, for the following Sections provide products from one of the following:
   1. Hubbell Incorporated.
   2. Wiremold; Legrand North America, LLC.

B. See drawings for additional information and requirements.

C. Flush-Type Floor Service Fittings:
   1. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
   2. Compartments: Barrier separates power from voice and data communication cabling.
   3. Service Plate and Cover: Rectangular die-cast aluminum with satin finish.
   4. Power Receptacle: NEMA WD 6 Configuration 5-20R, colors to be project standards (normal, UPS receptacles to be different colors per Architect), unless otherwise indicated.
   5. Data Communication Outlet: See preliminary low voltage systems drawings and confirm with Design-Build Low Voltage Contractor, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

D. Flap-Type Service Fittings:
   1. Description: Type: Modular, flap-type, dual-service units suitable for wiring method used, with flaps flush with finished floor.
   2. Compartments: Barrier separates power from voice and data communication cabling.
   3. Flaps: Rectangular, die-cast aluminum with satin finish.
   4. Service Plate: Same finish as flaps.
   5. Power Receptacle: NEMA WD 6 Configuration 5-20R, colors to be project standards (normal, UPS receptacles to be different colors per Architect), unless otherwise indicated.
   6. Data Communication Outlet: See preliminary low voltage systems drawings and confirm with Design-Build Low Voltage Contractor, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

## 2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: [Metal, with manufacturer's standard finish] [PVC].

D. Multioutlet Harness:
   1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
   2. Receptacle Spacing: 6 inches (150 mm).
   3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

# PART 3 EXECUTION

## 3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.
   5. Coordinate wall-mounted occupancy sensor switches with door swings; do not locate such that they will be blocked by open doors.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
1. device, listing conditions in the written instructions.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on botton. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

## 3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. In the Equipment Room, identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Perform the following tests and inspections:

C. Tests for Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Wiring device will be considered defective if it does not pass tests and inspections. Contractor to replace all defective wiring devices and retest.

3.4 COMMISSIONING

A. After the factory-authorized service representative has completed start-up for all of the lighting and receptacle control devices and systems, the Contractor shall arrange for the factory-authorized service representative to test the system with the Commissioning Agent.

B. The Contractor shall provide completed start-up forms and checklists to the Engineer and Commissioning Agent for all lighting and receptacle control systems and equipment.

C. The Contractor shall coordinate with the Owner, Architect and General Contractor; tests should be performed in the presence of the Owner, Commissioning Agent and Architect unless given specific permission otherwise in writing.

D. The factory-authorized service representative shall coordinate the commissioning of the lighting and receptacle controls with the Commissioning Agent per the Commissioning Plan. This shall include functional testing of:
1. All daylighting controls.
2. All occupancy and vacancy sensor.
3. All manual controls.

4. The lighting control panel scheduled dimming of corridor luminaires at night as indicated in the design documents, including manual override controls.
5. All exterior lighting controls; dusk to dawn and dusk to curfew fixtures.
6. Receptacle controls.

E. It is the responsibility of the Contractor and factory-authorized service representative to re-adjust or replace all equipment and devices that are not operating within the require parameters.

F. The Commissioning Agent will generate a Commissioning report summarizing the Commissioning process. The Contractor shall assist and provide documentation as required to complete this report.

END OF SECTION

SECTION 26 28 13

FUSES AND ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Cartridge Fuses.
3. Nonfusible switches.
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, 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.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2010 m).

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to Code.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

## 2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories: Provide accessories as required for specific installation/usage.

## 2.4 CARTRIDGE FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.

B. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.5 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories: Provide accessories as required for specific installation/usage.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

D. MCCBs shall be equipped with a device for locking in the isolated position.

E. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

F. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

G. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

H. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

I. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

J. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

K. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

L. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

M. Features and Accessories: Provide features/accessories as required for specific installation/usage. Including but not limited to:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Electrical Operator: Provide remote control for on, off, and reset operations.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than fifteen working days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Owner's written permission.
   4. Comply with NFPA 70E.

3.3 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

## 3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

## 3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:
   1. Visual and Mechanical Inspection:
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, grounding, and clearances.
      c. Verify that the unit is clean.
      d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      e. Verify that fuse sizes and types match the Specifications and Drawings.
      f. Verify that each fuse has adequate mechanical support and contact integrity.
      g. Verify correct phase barrier installation.
      h. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

C. Tests and Inspections for Molded Case Circuit Breakers:
   1. Visual and Mechanical Inspection:
      a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, grounding, and clearances.
      d. Verify that the unit is clean.
      e. Operate the circuit breaker to ensure smooth operation.
      f. Inspect operating mechanism, contacts, and chutes in unsealed units.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

## 3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Adjust relay and protective device settings according to recommended settings provided by the coordination study (see Specification Section 26 05 73). Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

END OF SECTION

# SECTION 26 43 13

# SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

## 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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:
   1. Section 262416 "Panelboards" for factory-installed SPDs.

### 1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 PANEL SUPPRESSORS

A. Manufacturers: Subject to project requirements, provide equipment by one of the following (for SPD integral to panelboards, provide from same manufacturer as panelboards):
   1. Eaton.
   2. GE by ABB, Electrification Products Division.
   3. Square D; a brand of Schneider Electric USA, Inc.
   4. Siemens Industry, Inc.

B. SPDs: Comply with UL 1449, Type 2.
   1. Include LED indicator lights for power and protection status.
   2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Comply with UL 1283.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120 V.

F. SCCR: Equal to the SCCR of the panelboard in which installed or exceed 100 kA.

G. Inominal Rating: 20 kA**.**

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

2.4 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:
1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
   1. Compare equipment nameplate data for compliance with Drawings and Specifications.
   2. Inspect anchorage, alignment, grounding, and clearances.
   3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 26 51 19

# INTERIOR AND EXTERIOR LIGHTING

## 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 interior and exterior luminaires, exit signs, emergency lighting units, and emergency lighting inverters.

### 1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   6. For each pole, accessory:
      a. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
      b. Include finishes for lighting poles and luminaire-supporting devices.
      c. Anchor bolts.
      d. Manufactured pole foundations.
   7. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calcula-

tion Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all luminaires and lamp types used on Project; use ANSI and manufacturers' codes.
2. Copies of all Manufacturers’ Warranties.

1.6 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

B. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

D. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below finished grade.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

C. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.

D. Warranty Period for Color Retention: Five years from date of Substantial Completion

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance:
1. Luminaires shall withstand the effects of earthquake motions determined according to the requirements of the local AHJ and the Project Structural Engineer.
2. Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7**,** the requirements of the local AHJ and the Project Structural Engineer.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 LUMINAIRE REQUIREMENTS

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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. See Luminaire Schedule in Contract Drawing Set for Luminaire Requirements for each Luminaire Type, Basis of Design manufacturers, Approved Alternate Manufacturers, etc.

2.3 EMERGENCY LIGHTING INVERTERS:

A. Manufacturers: Contingent upon compliance with project requirements, provide emergency lighting inverters from one of the following:
1. Chloride by Signify.
2. Power Sentry, Acuity Brands.
3. Isolite.
4. Sure-Lites, Cooper Lighting Solutions.

B. Provide emergency lighting inverters sized as required to serve emergency luminaires indicated on drawings without integral battery packs. The project is to be served by multiple small emergency lighting inverters, not one large central inverter.

C. UL 924 listed.

D. UL 924 self-testing and self-diagnostics.

E. Emergency lighting inverters are to be compatible with LED luminaires.

F. Emergency lighting inverters shall provide 90-minute run time.

G. Input voltage shall be field selectable at 120VAC or 277VAC.

H. Output voltage distortion shall be less than 10% for resistive loads.

I. Emergency lighting inverters shall have maintenance free VRLA batteries and a microprocessor-controlled, 3-stage battery charger.

J. Alarms shall include monthly test fault, yearly test fault, charger fault, output voltage low, output voltage high, overload fault, low voltage disconnect, heatsink over temp and input fuse failure.

K. Emergency lighting inverters shall have AIC rating as needed for available fault current as per the Contractor’s Short Circuit/ Fault Current calculcations.

L. Inverter operating temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).

M. Battery operating temperature: 68 degrees F to 86 degrees F (20 degrees C to 30 degrees C) per UL 924 specifications.

2.4 POLE REQUIREMENTS

A. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

B. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

C. Fasteners: Galvanized steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
   1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
   2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

D. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws

2.5 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Steel:
   1. ASTM A36/A36M for carbon structural steel.
   2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:
   1. Manufacturer's standard grade.
   2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260500 for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm) or as required by Structural Engineer and local AHJ, whichever is larger.

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting.

### 3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaires:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaires:
   1. Attached to structural members in walls or as per Manufacturer's Instructions and Structural Engineer's requirements.
   2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaires:
   1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
   2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

## 3.4 POLE AND BOLLARD FOUNDATIONS

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.
   1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

D. Direct-Buried Foundations: Install to depth required by Structural Engineer. Add backfill as required by Structural Engineer**,** tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.
   1. The Electrical Contractor is to hire a Structural Engineer currently registered in the State of Washington to engineer foundations for light poles and bollards and support structures for power conductors, communications cable tray, communications racks, etc. See Project Drawing set for additional information and requirements.

E. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.

## 3.5 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing or required by the Utilities, Code or the AHJ.
   1. Fire Hydrants and Water Piping: 60 inches (1520 mm)
   2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet (3 m)
   3. Trees: 15 feet (5 m) from tree trunk

C. Concrete Pole and Bollard Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles and Bollards: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers unless otherwise indicated.
   4. Use a short piece of 1/2 -inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

## 3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

## 3.7 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
3. Bond metal poles and bollards to grounding electrode system. See Project Drawing Set.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundation.

## 3.8 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

## 3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
3. Inspect poles for nicks, mars, dents, scratches, and other damage.

B. Luminaires will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

## 3.10 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to one visit to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective. Adjust luminaires that are no longer level.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION

SECTION 27 00 00

LOW VOLTAGE SYSTEMS GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Division 26.

1.2 SUMMARY

A. **This is a design/build specification**. Contract Documents are meant to provide information (scope, performance requirements, preliminary quantities and locations, etc) for Bidding by Design-Build Contractors only. All final quantities and locations of equipment and devices shall be coordinated with the Fire Marshal/ Local AHJ (as applicable), Architect and Owner prior to the start of construction.

B. Design Intent: The project includes Electrical, Fire Alarm and Low Voltage systems for a 12-unit, three story residential apartment project located in Kirkland WA..

C. All Fire Alarm and Low Voltage Systems are Design-Build; Contract Documents (drawings and specifications) are meant to provide information (scope, performance requirements, preliminary quantities and locations, etc) for Bidding by Design-Build Contractors only.

D. The Design-Build Contractors shall design, provide and install complete and fully operational and coordinated systems that meet all requirements of the Owner, local AHJ and as per the Project Contract Documents.
   1. All voice and data cabling design shall be performed by an RCDD or by a designer with five or more years of experience with telecommunications cabling design. Contractor to provide proof of designer qualifications.

E. Low Voltage Systems to be provided for the Project include:
   1. Fire Alarm System.
   2. Telecom Systems.
   3. CATV System.
   4. CCTV System.

F. The Contractor shall provide all labor, materials, equipment and devices, supports, etc necessary for satisfactory installation of fire alarm and low voltage work ready to operate in strict accordance with Code requirements and these specifications and drawings including but not limited to all switches, routers, CCTV cameras and NVR server, racks, patch panels, patch cables, 110 blocks, terminations, etc. The Contractor shall also provide permanent labeling at both ends of all low voltage cabling, color coded for each system, which shall match

the numbering scheme of the Low Voltage system As-Built drawings for all terminations.

1. The Contractor shall test all terminations to ensure they are in good working order. Any and all faulty cables and/ or terminations shall be replaced at no cost to the Owner.

G. All final quantities and locations of equipment and devices shall be coordinated with the Fire Marshal/ Local AHJ (as applicable), Architect and Owner prior to the start of construction.

H. Sustainability Goals: The Project is pursuing Evergreen Sustainable Development Standards (ESDS) Certification. The Contractor shall coordinate with the Architect and General Contractor to ensure compliance with the Prerequisites and intended Credits for the project. See Division 01 Specification and subsequent Division 26, 27 and 28 Specifications for additional information and requirements.

I. The Contractors shall provide all labor, materials, equipment and devices, supports, etc necessary for satisfactory installation of fire alarm and low voltage work ready to operate in strict accordance with Code requirements and these specifications and drawings.

J. Related Sections: All Division 01, 26, 27 and 28 Specification Sections included in the Contract Documents.

K. Commissioning Activities and Submittals: The Project shall be commissioned per Energy Code and ESDS requirements. The Contractor shall coordinate with the General Contractor, Architect and Commissioning Agent and provide support for the complete commissioning process as required. See Divisions 01, 26, 27 and 28 for additional information.

1.3 COORDINATION MEETINGS

A. The Design-Build Low Voltage Contractor shall coordinate with the Electrical and General Contractor to arrange for two coordination meetings/ conference calls for the low voltage systems for the project. The attendees shall include the Low Voltage Contractor, the Electrical Contractor, the General Contractor, the Owner/ Owner's Rep, the Owner's IT Department, the Architect and the Electrical Engineer.

B. The first meeting/ conference call shall occur within four (4) weeks of the Contractor receiving notice to proceed on the project and before the Low Voltage Contractor has issued their first set of shop drawings for the Low Voltage systems for the project. The intent of this meeting is for the Low Voltage Contractor to discuss design intent with the Owner and confirm the requirements for all systems.

C. The second meeting/ conference call shall occur within two (2) weeks of the Low Voltage Contractor issuing their first set of shop drawings for the Low Voltage systems for the project. The intent of this meeting is for the Low Voltage

Contractor to discuss specific equipment and device locations with the Owner and Architect.

1. The Design-Build Low Voltage Contractor shall issue their first round of shop drawing and schedule the second coordination meeting/ conference call before any low voltage systems, devices, equipment, etc have been roughed in.
2. The second meeting /conference call shall be scheduled to allow for enough time for the Design-Build Low Voltage Contractor to issue a second set of shop drawings for Owner and Engineer review and comment before rough-in for these systems needs to begin.
3. Any equipment, devices, etc for any low voltage systems roughed-in before the second meeting/ conference call shall be relocated as needed at the Contractor's expense.

1.4 SYSTEMS REQUIREMENTS

A. The Fire Alarm and Low Voltage Contractors shall provide all racks, parts, pieces, cabling, equipment, devices, supports, etc required for complete and fully operational low voltage and fire alarm systems per Code, AHJ, and Owner requirements.

B. FIRE ALARM SYSTEM
1. See Specification Section 28 46 00.

C. TELECOM AND CATV SERVICES:
1. The Contractor shall coordinate with the Owner to confirm the desired telecom utilities for the project. For bidding purposes, assume three providers for the building (CenturyLink, Xfinity/Comcast and WaveG).
2. The Electrical Contractor shall coordinate with the Owner's desired telecom providers to bring service to the building.
3. The Electrical Contractor shall also coordinate with any existing providers at the site to relocate and/ or remove all existing conduit and cabling in conflict with the scope of the project.
4. See Site Plan for preliminary conduit requirements and service points. Contractor to confirm final requirements and service points with utility service providers.
    a. For CenturyLink service conduits, maximum allowed is two 90-degree bends before a CenturyLink approved pull box must be installed.
    b. For Comcast service conduits, maximum allowed is 270 degrees of bends. Provide 36-inch radius sweeps.

D. TELECOM AND CATV SYSTEMS:
1. See the Bid Set Electrical drawings for additional information and requirements including preliminary device quantities and locations for bidding purposes.
2. The Contractor shall design, provide and install complete and fully operational Telecom and CATV systems for the project. Coordinate exact requirements, locations and device types with the Owner.
3. System Risers:

a. Comcast will provide all broadband coaxial cable or fiber from the MDF room to each IDF. Electrical Contractor to coordinate with Comcast to confirm conduit requirements.
b. Low Voltage Contractor shall provide riser cabling for all other low voltage systems/ providers and for the Owner's network. Confirm requirements with individual utility service providers and the Owner.
c. Low Voltage Contractor shall provide a line-item price to remove cabling for CenturyLink service should CenturyLink provide fiber vertically for the project.

4. Telecom equipment and cabling shall meet TIA performance criteria for Category 6. All cabling is to be terminated with Category 6 jacks.
5. The Design-Build Contractor shall coordinate with the Owner to confirm telecom system requirements prior to the start of design.
6. The CATV system shall consist of cable television service and a coaxial cable distribution system.
   a. Headend equipment shall consist of receiving equipment and associated signal distribution amplification and equalization.
   b. Distribution of cable television service signals, which includes coordinating with Owner's selected service provider for installation of cable to the service point ready for connection into the distribution system. Obtain signal levels and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.
   c. Cable distribution system consisting of coaxial cables, user interfaces, signal taps and splitters, RF amplifiers, signal equalizers, power supplies, and required hardware, complying with CEA-310-E and CEA-2032 and resulting in performance parameters specified in this Section. System shall be capable of distributing television channels according to CEA-542-B.
7. Dwelling Units:
   a. Media panels are to be provided in the units; CATV and phone outlets in each unit are to be homerunned from these Media Panels (see drawings).
      1) Provide Primex 42-inch plastic enclosure or pre-approved equal sized as required to house phone, date, and CATV terminations and distribution components.
   b. Contractor shall provide one RG-6 cable and two CAT6 cables to each media panel from the serving IDF closet.
      1) Where units are over 150 ft from the IDF closet, Contractor shall provide RG-11 cabling in lieu of RG-6.
      2) Contractor to install Comcast provided 12.7mm Duraline with fiber to each unit.
      3) Contractor to provide alternate pricing to install CenturyLink provided ruggedized fiber to each unit.
      4) Contractor to provide line-item pricing to remove one CAT6 cable to each unit from Project.
   c. See typical unit enlarged plan in the Bid Set Drawing set for design intent for units.

8. In addition to devices noted on the Bid Set drawings, the Design-Build Contractor shall also provide:
   a. Dedicated phone lines for the access control, fire alarm and two-way communication systems and for the elevator as required by Code, local AHJ and the Fire Marshal.
   b. Any other devices required by Code, AHJ or Fire Marshal.

E. CCTV SYSTEM
1. The Contractor shall design, provide and install a complete and fully operational CCTV system for the project. Coordinate exact requirements, locations and device types with the Owner.
2. CCTV system shall be controlled by ExacqVision Video Management Systems (VMS) Solutions.
3. See the Bid Set drawing set for additional information and requirements. Provide system capable of supporting cameras shown plus an additional 25% capacity in the future.
4. System is to use high-resolution color cameras with 7fps recording capabilities and NVR equipment. The Contractor is to provide and install all equipment, devices, supports, software, cameras, etc and coordinate final camera quantities with the Owner.
5. Gateway NVR to be set up in manager's office.
6. Storage capacity shall be provided for at least 3 month of camera footage for all cameras in the project.
7. Monitors and live feeds shall be provided at the Building Manager's Desk.
   a. Remote access to the system shall also be provided to allow access to the video footage from off site.
8. Monitors to be set to a low resolution, but the recordings are to be set at a high resolution.
9. 180d cameras should be avoided whenever possible due to fishbowl effect and lack of image clarity around edges of view.

1.5 CODES AND STANDARDS:

A. All work shall meet or exceed the requirements of the current versions of all applicable Federal, State, and Local Codes and Standards including but not limited to:
1. National Electrical Code (NEC) with Local Amendments.
2. Washington State Energy Code with Local Amendments.
3. ESDS Requirements.
4. International Fire Code (IFC) with Local Amendments.
5. International Building Code (IBC) with Local Amendments.
6. International Mechanical Code (IMC) with Local Amendments.
7. Uniform Plumbing Code (UPC) with Local Amendments.
8. The Americans with Disabilities Act (ADA).
9. Illuminating Engineering Society of North America (IESNA) Standards and Recommended Practices.
10. National Fire Protection Association (NFPA) Standards and Recommended Practices.
11. Applicable Standards of the following organizations (see subsequent Division 26, 27 and 28 sections for additional information):

a. American National Standards Institute (ANSI).
b. American Society for Testing Materials (ASTM).
c. Building Industry Consulting Services International (BICSI)
d. Institute of Electrical and Electronics Engineers (IEEE)
e. National Electrical Manufacturer's Association (NEMA)
f. U.S. Department of Housing and Urban Development (HUD)
g. Underwriter's Laboratories (UL) standards.

12. Utility Service Provider Requirements.

1.6 SUSTAINABLE DESIGN REQUIREMENTS:

A. Comply with Construction Management Plan. Refer to Division 01.

B. ESDS-Compliant Products: Inside the building envelope, use materials that contain acceptable or lower levels of VOC per referenced standards in Rating System Requirements and no added urea-formaldehyde. Cleaning products used during construction and close-out procedures shall meet Green Seal standards GS-34, GS-37, and SG-40, or the California Code of Regulations, Title 17 Section 94509, VOC standards for cleaning products.

C. Refer to Division 01 for a complete list of ESDS Prerequisites and Credits anticipated for the project.

1.7 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, Fire Marshal, and UL for fire resistance ratings and surface burning characteristics.

1.8 PRODUCT SUBSTITUTIONS

A. Manufacturers and models of equipment and material indicated in Divisions 27 and 28 Specifications and on drawings are those upon which the fire alarm and low voltage systems designs are to be based; other manufacturers with products considered equal in general quality may also be listed without specific model designation. Manufacturers not listed shall be submitted for approval prior to submission of Bid by the Contractor, see Division 01.

B. Any equipment other than the basis of design is considered a substitution; this includes equipment from any alternate manufacturers listed without specific model designation in the Contract Specifications and / or Drawings.

C. Pre-Bid Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

D. In selecting substitute equipment, the Contractor is responsible for and shall guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Approval of proposed substitution does not grant the Contractor approval for deviation from the contract requirements.

F. Unless indicated otherwise, “or approved equal” may be assumed for all products in Divisions 26, 27 and 28.

1.9 DESIGN DRAWINGS

A. All drawings, specifications and calculations prepared by the Fire Alarm Design-Build Contractor shall be stamped by an Engineer currently registered in the State of Washington.

B. The Design-Build Contractor shall submit drawings and diagrams for review and for job coordination :
   1. Permit / Construction Drawings for review. These drawings shall be submitted at two milestones as selected by the Architect in electronic PDF format.
      a. The Contractors’ drawings shall match the layout of the Architectural drawings.
      b. Fire Alarm systems shall be provided in a separate set of drawings by the Fire Alarm Contractor.
      c. The Drawing Sets shall include at a minimum:
         1) Symbols, Legend and drawing list sheets.
         2) Low Voltage Systems (Telecom, CATV, access control, etc) floor plan drawings.
         3) Low Voltage Systems riser diagrams.
         4) Fire Alarm System sheets and calculations approved by the local Fire Marshal/ AHJ.

1.10 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under “Part 2 Products” of Divisions 27 and 28 Specification Sections and all additional products noted on drawings or required for completion of sequence of operations.

B. Provide the Submittals so as not to delay the construction schedule; allow at least two weeks for review of each submittal and re-submittal.

C. Electronic: Submittals shall be complete in one PDF file for each Division with bookmarks for each Specification Section and Principal Category. Multi-file submittals will be returned without review.
   1. First Page: Name of Project, Owner, Location & Contracting Company.
   2. Index Page: List of specification sections and principal categories with contents by Tag or item.
   3. Bookmarks: Electronic bookmark of each specification section and principal category corresponding to listing in index.

D. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

E. Equipment vendor cover page with contact information shall precede submittal by that vendor.

F. Submitted product information shall include (as applicable) but not be limited to the following information:
1. Product description.
2. Manufacturer and model.
3. Dimensions.
4. Performance Ratings.
5. Construction Materials.
6. Ratings (i.e. UL, ASTM, NEMA, etc).
7. Electrical characteristics (Voltage, Phase, Wattage, Breakers, etc).
8. Engineering technical data.
9. Sound level data.
10. Vibration Isolation.
11. Controls and wiring diagrams.
12. Accessories.

G. If requested in subsequent Specification Sections or by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

H. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

I. The Contractor agrees to pay for the Engineer’s review cost of the Division 27 and 28 Submittals beyond one resubmittal where resubmittals are required due to deficiencies in the Contractor’s Submitted material.

1.11 SHOP DRAWINGS

A. The Contractor shall submit drawings and/or diagrams for review and for job coordination:
1. Slab plans marked up with all penetrations required for electrical, fire alarm and low voltage systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.
2. For all special or custom-built items or equipment.
3. In all cases where deviation from the Contract Drawings are contemplated because of job conditions, interference or substitution of equipment, or when requested by the Engineer for purposes of clarification of the Contractor’s intent.
a. By submission of revised design shop drawings, the Contractor acknowledges that coordination has been done with all other trades to ensure that all equipment fits and remains accessible with all Code required clearances and that no conflicts exist.

B. The Architect’s review of shop drawings shall not relieve the Contractor of the responsibility for deviations from the Contract drawings or specifications, unless

he has, in writing, called the attention of the Architect to such deviations at the time of the submission, nor shall it relieve him from responsibility for errors or omission in such shop drawings.

1.12 ESDS RELATED DOCUMENTATION AND ACTIVITIES

A. Provide commissioning documentation per EA Prerequisite 1 and as the Commissioning Authority (CxA) requests.

B. Comply with IAQ Management Plan by the general contractor.

C. Submit the ESDS VOC Form, for any VOC-containing material to be used inside the building envelope, including materials for patching, touch-up and cleaning

D. Construction Waste Management: Retain and submit all trip and tip tickets for all construction debris and waste removed from site, indicating material content, tonnage, date hauled and facility to where materials were hauled. This submittal is to the general contractor only.

1.13 PERMITS

A. In addition to the distribution requirements specified in other Specification Sections, the Design-Build Contractor shall make all required submissions to the Authorities Having Jurisdiction (AHJ) for Permits and approval for applicable low voltage systems (Fire Alarm, etc). The Contractor shall pay all fees related to said submissions. The Contractor shall revise their design and resubmit as needed to obtain AHJ approval. All additional and / or revisions to the Contractor's designs required to obtain AHJ approval shall be carried out by the Contractor at no additional cost to the Owner – this includes the fees associated with any resubmissions. The Contractor shall submit all comments received from the AHJ to the Architect and Engineer.

B. The Contractor shall not commence work until a permit (or "get started" permit where allowed by the AHJ) is obtained. Contractor is solely responsible for ensuring that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

1.14 QUALITY ASSURANCE

A. The Contractors shall perform all work per current versions of all applicable Codes and Standards with state and local amendments – see "Codes and Standards" paragraph above.

B. All equipment and devices shall be UL-Listed and Labeled and shall be acceptable to the Authority Having Jurisdiction as suitable for the use and location for which they are intended.

C. Provide all like items (telecom outlets, patch panels, faceplates, etc) from one manufacturer.

1.15 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in Divisions 27 and 28 Specification Sections with a minimum of three years' experience.

B. Installer: Company specializing in performing Work included in Divisions 27 and 28 on projects of similar type and scale with a minimum of three years' experience.

1.16 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. The Contractor shall keep all equipment, devices, conduit, etc in a dry, secured, protected area. The location shall be coordinated with the Architect and General Contractor prior to the start of Construction. See Division 01 for additional delivery, storage and handling requirements.

C. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

D. Inspect all products and materials for damage prior to installation.

E. Protect conduit from all entry of foreign materials by providing temporary end caps or closures on conduit and fittings.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Comply with manufacturer's installation instruction for rigging, unloading and transporting equipment.

1.17 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Coordinate with General Contractor to have ventilation provided in areas to receive solvent cured materials.

C. Do not install underground conduit when bedding is wet or frozen.

1.18 FIELD MEASUREMENTS

A. Verify field measurements prior to ordering racks and other equipment.

B. Verify by field measurements that equipment and rack sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining and documenting exact locations of existing systems.

1.19 COORDINATION

A. The Contractor shall visit the site and become familiar with existing conditions affecting work. The Contractor shall include in their Bid the costs for all work and / or materials required to comply with the requirements of the Contract Documents based on the actual existing conditions. Failure to visit the Site and verify actual existing conditions does not relieve the Contractor of these requirements; no change orders will be paid due to lack of verification of existing conditions whether they are specifically noted in the Contract Documents or not.

B. The Contractor shall verify the locations of any overhead or buried utilities on or near the Project site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. Where the word ‘verify’ is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

E. Where the drawings or specifications call out for the contractor to field verify and / or coordinate locations and requirements this verification / coordination is to be completed prior to any equipment, devices, supports, conduits, etc are installed / roughed-in. Any equipment, devices, supports, conduits, etc installed at locations unacceptable to the design team (either for aesthetics or functionality) due to the contractor failing to field verify / coordinate shall be relocated at the contractor's expense.

F. Electrical and Low Voltage Systems drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments as necessary to fit actual conditions.

G. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or equipment roughed in improperly and not positioned on implied centerlines or as required by good practice shall be repositioned at no cost to the Owner.

H. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping

and sprinklers. Starting with the lowest priority, the Electrical, HVAC, plumbing, and sprinkler contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

I. Advise the Architect of any modifications required to suit the equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

J. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

K. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

M. Coordinate wall openings, rough-in locations, concrete housekeeping pads, and conduit rough-in locations to accommodate Work of Divisions 26, 27 and 28.

N. The Contractor shall coordinate with the Architectural plans and Project structure when locating equipment and devices and routing conduit and cabling.

O. The Contractor shall coordinate with the General Contractor and provide slab plans marked up with all penetrations required for electrical, fire alarm and low voltage systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.

P. The Contractor shall coordinate conduit and cabling routing and equipment and device locations with all other trades to ensure all Code required clearances are maintained and equipment and devices remain accessible after the work of all trades is complete.

Q. The Contractor shall consult the approved shop drawings of all other trades and crafts to ensure coordination with final locations of cabinetry, counters, appliances, equipment, structural members, etc. Conflicts are to be resolved with the Architect and General Contractor prior to rough-in. The Contractor shall not be paid for relocation work (including cutting, patching, and finishing) required due to a lack of coordination prior to installation.

R. See the Architectural drawings for the exact locations of low voltage devices. The Contractor shall make minor changes (less then 6-feet in any direction) in the location of conduit, boxes, devices, etc from the locations shown in the drawings without extra charge to the Owner where required by coordination or if directed by the Architect or Owner.

S. Prior to the start of Construction, coordinate locations and connection requirements for all line voltage power connections with the Electrical Contractor and Engineer.

1.20 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout:
   1. Walk through the Project with the Owner and Architect to make note of deficiencies.
   2. Execution of Owner's, Architect's and Engineer's final observation reports (punchlist).
   3. Operating and Maintenance Instructions.
   4. Operating and Maintenance Manual.
   5. Equipment Cleaning.
   6. Record Drawings.
   7. Testing.
   8. Commissioning and Commissioning Report.
   9. Warranty.

B. See other Divisions 01, 27 and 28 Specification Sections for additional requirements.

1.21 OPERATING AND MAINTENANCE INSTRUCTIONAL TRAINING

A. General: In addition to requirements of Division 01, following initial operation of Electrical systems and prior to acceptance by the Architect, perform the following services:
   1. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.
   2. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment and device calibration; systems set up, adjustments and programming; and safeties and alarms.
   3. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where equipment startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.
   4. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
      a. Provide documentation of all instruction which includes:
         1) Date and time of instruction.
         2) Name, affiliation and qualifications of the instructor.
         3) Name and affiliation of the attendees.
         4) Topics, systems, and equipment covered.
         5) Length of instruction.
   5. Minimum duration of instruction periods:
      a. Telecom and CATV Systems 1 hour

| | | |
|---|---|---|
| b. | CCTV System | 2 hours |
| c. | Fire Alarm Systems | See Section 28 46 00 |

1.22 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 01, one PDF and one bound copy of operating and maintenance manuals to include the following:
   1. The Job name and address.
   2. Names, addresses and telephone numbers of the Contractor, sub-contractors and local companies responsible for maintenance of each system or piece of equipment.
   3. Manufacturers, suppliers, contractor names, addresses and phone numbers.
   4. Written guarantees.
   5. Warranty service contractors' names, address and phone numbers (if different from above).
   6. Copies of approved brochures and Shop Drawings as applicable for all submittal items.
   7. Manufacturer’s printed operating procedures to include start-up and routine and normal operating instructions; and control, shutdown, and emergency instructions.
   8. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; and adjusting instructions.
   9. Part numbers of all replaceable items.
   10. Operation sequences.
   11. Record drawings corrected and completed.
   12. Completed equipment start-up forms and checklists.
   13. Final copy of testing reports.

B. Operation and Maintenance Data:
   1. Include spare parts lists for all equipment as applicable.
   2. Submit installation instructions, adjustment instructions, and spare parts lists for all equipment.
   3. Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
   4. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

C. Binders:
   1. Furnish typewritten or printed index and tabbed dividers between principal categories.
   2. Bind each manual in a hard-backed loose-leaf binder.
   3. Imprint on Cover:
      a. Name of Project.
      b. Owner.
      c. Location of project.
      d. Architect.
      e. Contractor.
      f. Year of Completion.

4. Imprint on backing:
   a. Name of Project.
   b. Year of completion.

D. PDFs:
1. Provide PDF with bookmarks for each Specification Section and / or Principal Category.
   a. First Page: Name of Project, Owner, Location & Contracting Company.
   b. Index Page: List of specification sections with contents by Tag or item.
   c. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

E. Submittal:
1. Preliminary Copies: Prior to scheduled completion of the project, submit one PDF copy for review by the Architect.
2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

1.23 RECORD DRAWINGS

A. Prepare record documents in accordance with the requirements of Division 01 Specification Section "Contract Closeout."

B. Label each drawing as "Record Drawing" with Low Voltage Contractors' name and date.

C. During construction, maintain an accurate record set of the drawings of the installation on project site at all times; keep this set in a safe location, protected from the environment.

D. Submit one digital file with all drawings in PDF format.

E. Make all notes and revisions on PDF set in red.

F. In addition to the requirements specified in Division 01 and in other Division 26, 27 and 28 Specification Sections, indicate installed conditions (locations, sizes, burial depths, arrangements, etc) for:
1. Major raceway systems – Interior and Exterior – dimensions from prominent building lines.
2. Utility service conduit (power and telecom) and connections, dimensions from prominent building lines.
3. Locations of all conduits provided for future use with intended future use identified.
4. Equipment locations (exposed and concealed) shown to scale and dimensioned from prominent building lines.
5. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.24 TESTING

A. All cabling shall be tested by a certified installer.

B. Provide completed start-up forms and checklists.
   1. Contractor to test all horizontal UTP cables per TIA 568.B.2 for CAT6 performance requirements.

C. Perform testing of fire alarm, two-way communications, and DAS systems as described in Division 26, 27 and 28 Specification Sections and as required by applicable codes and ordinances.

D. Written verification of testing to be signed by Owner's Representative.

1.25 WARRANTY AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. The Contractor shall, without cost to the Owner, correct all defects and failures discovered within one year from date of final acceptance for all electrical, fire alarm, two-way communications, and DAS systems, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.
   1. See individual Specification Sections for additional requirements.
   2. Telecom terminations and cabling shall be provided with a 15 year warranty.

C. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

D. The Contractor shall make all necessary control adjustments during first year of operation.

E. The presence of any inspector or observer at any point during construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

F. Refer to Division 01, 26, 27 and 28 Specification Sections for additional Warranty requirements.

PART 2 PRODUCTS

2.1 CABLE TRAYS

A. Subject to compliance with requirements, provide equipment, devices and cabling by one of the following manufacturers or a pre-approved equal:
   1. Cable Management Solutions, Inc.
   2. Cablofil Inc.
   3. Cooper B-Line, Inc.

4. Cope; Atkore International.
5. GS Metals Corp.
6. Monosystems, Inc.
7. MP Husky Cable Tray and Cable Bus.
8. Wiring Device-Kellens; Hubbell Incorporated

B. Comply with TIA/EIA-569-A.

C. Sizes and Configurations: See the Drawings for preliminary requirements for types, materials, sizes, and configurations. Confirm final sizes and configurations with the Low Voltage Design-Build Contractor.

D. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
1. Source Limitations: Obtain cable trays and components from single manufacturer.

E. Description:
1. Width: as indicated on Drawings.
2. Minimum Usable Load Depth: 6 inches (150 mm).
3. Straight Section Lengths: 10 feet (3.0 m) or 12 feet (3.7 m), except where shorter lengths are required to facilitate tray assembly.
4. Rung Spacing: 6 inches (150 mm) o.c.
5. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
6. Support Point: Splice fittings shall be hanger support point.
7. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
8. Unbalanced Loads: Maintain cable tray rungs within six degrees of horizontal under all loading conditions.
9. Splicing Assemblies: Bolted type using serrated flange locknuts.
10. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
11. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.
12. Materials: Aluminum alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
13. Hardware: Chromium-zinc-plated steel, ASTM F1136.

F. CABLE TRAY GROUNDING
1. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" and the design drawings.
2. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
3. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt

attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

4. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

2.2 UTP CABLE

A. Subject to compliance with requirements, provide equipment, devices and cabling by one of the following manufacturers or a pre-approved equal:
   1. Belden CDT, Inc, Electronics Division.
   2. Berk-Tek.
   3. CommScope, Inc.
   4. KRONE, Inc.
   5. Superior Essec, Inc.

B. Description: 100-ohm, 100 pair UTP formed into 25-pair binder groups covered with thermoplastic jacket.
   1. Comply with TIA/ EIA-568-B.2, Category 6.

2.3 TELECOM/ CATV EQUIPMENT:

A. Subject to compliance with requirements, provide equipment, devices and cabling by one of the following manufacturers:
   1. Belden, Inc.
   2. Cooper B-Line.
   3. Hubbell Premise Wiring.
   4. Leviton Commercial Networks Division.
   5. Motorola, Inc.; Connected Home Solutions.
   6. Ortronics, Inc.
   7. Tyco Electronic Corporation.

B. The telecom equipment, devices and cabling shall meet TIA performance criteria for Category 6. All cabling shall be terminated with Category 6 RJ45 jacks.

C. MEDIA PANELS (SMART BOXES):
   1. Provide Primex 42-inch plastic enclosure or pre-approved equal sized as required to house phone, date, and CATV terminations and distribution components.
   2. Media Panel shall include an internal duplex receptacle.
   3. Provide Leviton CAT6 RJ-45 splitter or pre-approved equal for voice/ data and CATV distribution.

2.4 CCTV SYSTEMS

A. CAMERAS:
   1. Provide CCTV cameras as required for coverage of areas indicated on plans by one of the following manufacturers or as otherwise required by the Owner.
      a. Axis

b. Philips
c. Pelco
d. Panasonic

2. Coordinate all final camera specifications, requirements and locations with the Owner prior to starting the design of the system.

B. DVR/ NVR EQUIPMENT:
1. Provide equipment per the Owner requirements by one of the following or as otherwise required by the Owner:
a. Philips
b. Pelco
c. Panasonic
2. Coordinate all final system specifications and requirements with the Owner prior to starting the design of the system.

C. MONITORS:
1. Provide equipment per the Owner requirements by one of the following or as otherwise required by the Owner:
a. Philips
b. Pelco
c. Panasonic
2. Coordinate all final system specifications and requirements with the Owner prior to starting the design of the system.

2.5 HANGERS AND SUPPORTS

A. See Specification Section 26 00 01.

2.6 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. See Specification Section 26 05 19.

2.7 GROUNDING AND BONDING

A. See Specification Section 26 05 26.

2.8 RACEWAY AND BOXES

A. See Specification Section 26 05 33.

2.9 IDENTIFICATION FOR LOW VOLTAGE SYSTEMS

A. See Specification Section 26 05 53.

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction the Contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. The Contractor will revise and/or prepare drawings for submittal.

3.2 MOCK-UPS

A. The Contractor shall completely mock-up one of each typical unit type, the offices and the common areas (exact units and areas to be chosen by the Architect and Owner) by marking the intended locations of all equipment and devices.

B. Before starting installation of equipment and devices, the Electrical Contractor shall walk through all mocked-up areas with the Owner, Architect, and General Contractor to receive approval for all locations.

C. The Electrical Contractor shall relocate equipment and devices in the mock-ups per the Owner and Architect's instructions.

D. The Electrical Contractor shall relocate any equipment and devices installed prior to the approval of the mocked-up areas by the Architect and Owner at the Electrical Contractor's expense.

3.3 INSTALLATION

A. The Contractor shall conceal all conduit, cabling and boxes in finished areas unless indicated otherwise or granted specific permission by the Architect. Install all conduit and cabling perpendicular or parallel with building lines wherever possible.

B. In open ceiling areas, all cabling shall be installed in conduit. Conduit shall be painted; color as selected by the Architect.

C. Coordinate the locations of equipment and outlets with all other trades.

3.4 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work (including the electric and telecom utility providers for utility service infrastructure work).

B. Should any work be enclosed or covered up before such inspection and testing, the Contractor shall at his own expense uncover said work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition including paying other trades to repair work under their scope that was disturbed.

3.5 FIELD QUALITY CONTROL

A. Conducts tests of equipment, devices, and systems as required by NFPA, BICSI, local Codes and the local AHJ.
   1. Provide a Service Technician with all tools, instruments, etc required to complete required tests.
   2. Coordinate with the Owner, Architect and General Contractor; tests should be performed in the presence of the Owner and Architect unless given specific permission otherwise.

B. Refer to individual Division 26, 27 and 28 Specification Sections for additional requirements.

3.6 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

C. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of conduit and equipment. Any collection of material shall be thoroughly cleaned before owner occupancy.

D. Clean exterior of all exposed conduit.

E. Use ESDS Compliant Products: Materials intended for use inside the building envelope, including those used for patching, painting, touch-up, and cleaning, must contain acceptable levels of VOC's and contain no added urea-formaldehyde.

3.7 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of low voltage systems work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting where possible by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for low voltage systems installations.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.8 SALVAGE

A. Remove excess conduit and conductors. Remove scrap and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

3.9 MANUFACTURERS' FIELD SERVICES

A. Refer to individual Division 26, 27 and 28 Specification Sections for requirements.

3.10 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 28 46 00

FIRE ALARM GENERAL CONDITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to General Conditions, Supplementary Conditions, the modifications thereto and Division 01 - General Requirements for all work in Divisions 26, 27 and 28.

1.2 SUMMARY

A. **This is a design/build specification**. Contract Documents are meant to provide information (scope, performance requirements, preliminary quantities and locations, etc) for Bidding by Design-Build Contractors only. All final quantities and locations of equipment and devices shall be coordinated with the Fire Marshal/ Local AHJ (as applicable), Architect and Owner prior to the start of construction.

B. Design Intent: The project includes Electrical, Fire Alarm and Low Voltage systems for a 12-unit, three story residential apartment project located in Kirkland WA.

C. All Fire Alarm and Low Voltage Systems are Design-Build; Contract Documents (drawings and specifications) are meant to provide information (scope, performance requirements, preliminary quantities and locations, etc) for Bidding by Design-Build Contractors only.

D. The Fire Alarm and Low Voltage Design-Build Contractor(s) shall be subcontractor(s) to the Electrical Contractor. The Design-Build Contractors shall design, provide and install complete and fully operational and coordinated systems that meet all requirements of the Owner, local AHJ and as per the Project Contract Documents.
   1. All voice and data cabling design shall be performed by an RCDD or by a designer with five or more years of experience with telecommunications cabling design. Contractor to provide proof of designer qualifications.

E. Low Voltage Systems to be provided for the Project include:
   a. Fire Alarm System.
   b. Telecom Systems.
   c. Wireless Network at offices and Amenity Spaces.
   d. CATV System.
   e. CCTV System.

F. The Contractor shall provide all labor, materials, equipment and devices, supports, etc necessary for satisfactory installation of fire alarm and low voltage work ready to operate in strict accordance with Code requirements and these specifications and drawings including but not limited to all switches, routers, CCTV cameras and NVR

server, racks, patch panels, patch cables, 110 blocks, terminations, etc. The Contractor shall also provide permanent labeling at both ends of all low voltage cabling, color coded for each system, which shall match the numbering scheme of the Low Voltage system As-Built drawings for all terminations.

1. The Contractor shall test all terminations to ensure they are in good working order. Any and all faulty cables and/ or terminations shall be replaced at no cost to the Owner.

G. All final quantities and locations of equipment and devices shall be coordinated with the Fire Marshal/ Local AHJ (as applicable), Architect and Owner prior to the start of construction.

H. Sustainability Goals: The Project is pursuing Evergreen Sustainable Development Standards (ESDS) Certification. The Contractor shall coordinate with the Architect and General Contractor to ensure compliance with the Prerequisites and intended Credits for the project. See Division 01 Specification and subsequent Division 26, 27 and 28 Specifications for additional information and requirements.

I. Related Sections: All Division 01, 26, 27 and 28 Specification Sections included in the Contract Documents.

J. Commissioning Activities and Submittals: The Project shall be commissioned per Energy Code and ESDS requirements. The Contractor shall coordinate with the General Contractor, Architect and Commissioning Agent and provide support for the complete commissioning process as required. See Divisions 01, 26, 27 and 28 for additional information.

1.3 SYSTEMS REQUIREMENTS

A. FIRE ALARM SYSTEM

1. A complete and fully operational Addressable Fire Alarm system meeting all Code and Fire Marshal requirements shall be designed, provided and installed for the project by the Design-Build Contractor.
2. Non-system smoke detectors and carbon monoxide alarms are to be provide in all dwelling units per the requirements of Code and the Fire Marshal.
3. In addition to device requirements at Type A units, All Type B1 units are also to have system horn/ strobe devices installed (Type B1 units should be installed as per requirements of Type A Units).
4. In addition to device requirements at Type A and Type B1 units, all Type B Units are to be pre-wired to allow for future installation of fire alarm system horn/ strobes.
5. Please note, there are three Type 1 range hoods in the project; one in the Common Kitchen in the Base Building and two in the EYFO Child Care kitchen. See plans for additional information and locations. Fire Alarm contractor to connect complete ANSUL systems per Code requirements. Coordinate requirements with hood providers and all other trades.

1.4 CODES AND STANDARDS:

A. All work shall meet or exceed the requirements of the current versions of all applicable Federal, State, and Local Codes and Standards including but not limited to:
1. National Electrical Code (NEC) with Local Amendments.
2. Washington State Energy Code with Local Amendments.
3. ESDS Requirements.
4. International Fire Code (IFC) with Local Amendments.
5. International Building Code (IBC) with Local Amendments.
6. International Mechanical Code (IMC) with Local Amendments.
7. Uniform Plumbing Code (UPC) with Local Amendments.
8. The Americans with Disabilities Act (ADA).
9. Illuminating Engineering Society of North America (IESNA) Standards and Recommended Practices.
10. National Fire Protection Association (NFPA) Standards and Recommended Practices.
11. Applicable Standards of the following organizations (see subsequent Division 26, 27 and 28 sections for additional information):
a. American National Standards Institute (ANSI).
b. American Society for Testing Materials (ASTM).
c. Building Industry Consulting Services International (BICSI)
d. Institute of Electrical and Electronics Engineers (IEEE)
e. National Electrical Manufacturer's Association (NEMA)
f. U.S. Department of Housing and Urban Development (HUD)
g. Underwriter's Laboratories (UL) standards.
12. Utility Service Provider Requirements.

1.5 SUSTAINABLE DESIGN REQUIREMENTS:

A. Comply with Construction Management Plan. Refer to Division 01.

B. ESDS-Compliant Products: Inside the building envelope, use materials that contain acceptable or lower levels of VOC per referenced standards in Rating System Requirements and no added urea-formaldehyde. Cleaning products used during construction and close-out procedures shall meet Green Seal standards GS-34, GS-37, and SG-40, or the California Code of Regulations, Title 17 Section 94509, VOC standards for cleaning products.

C. Refer to Division 01 for a complete list of ESDS Prerequisites and Credits anticipated for the project.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to International Building Code with local amendments, Fire Marshal, and UL for fire resistance ratings and surface burning characteristics.

1.7 PRODUCT SUBSTITUTIONS

A. Manufacturers and models of equipment and material indicated in Divisions 27 and 28 Specifications and on drawings are those upon which the fire alarm and low voltage systems designs are to be based; other manufacturers with products considered equal in general quality may also be listed without specific model designation. Manufacturers not listed shall be submitted for approval prior to submission of Bid by the Contractor, see Division 01.

B. Any equipment other than the basis of design is considered a substitution; this includes equipment from any alternate manufacturers listed without specific model designation in the Contract Specifications and / or Drawings.

C. Pre-Bid Substitutions will be evaluated based on product manufacturer only. Specific product model, specifications, options and accessories will be evaluated during submittals. Approval of a manufacturer substitution does not constitute approval of the submitted product.

D. In selecting substitute equipment, the Contractor is responsible for and shall guarantee equal performance and fit. Cost of redesign and all additional costs incurred to accommodate the substituted equipment shall be borne by the Contractor.

E. Approval of proposed substitution does not grant the Contractor approval for deviation from the contract requirements.

F. Unless indicated otherwise, “or approved equal” may be assumed for all products in Divisions 26, 27 and 28.

1.8 DESIGN DRAWINGS

A. All drawings, specifications and calculations prepared by the Fire Alarm Design-Build Contractor shall be stamped by an Engineer currently registered in the State of Washington.

B. The Design-Build Contractors shall submit drawings and diagrams for review and for job coordination:

1. Permit / Construction Drawings for review. These drawings shall be submitted at two milestones as selected by the Architect in electronic PDF format.
    a. The Contractors’ drawings shall match the layout of the Architectural drawings.
    b. The Drawing Sets shall include at a minimum:
        1) Symbols, Legend and drawing list sheets.
        2) Equipment Schedules.
        3) Fire Alarm System sheets and calculations approved by the local Fire Marshal/ AHJ.

1.9 SUBMITTALS

A. Provide one electronic copy of product data submittals for all products listed under "Part 2 Products" this specification and all additional products noted on drawings or required for completion of sequence of operations.

B. Provide the Submittals so as not to delay the construction schedule; allow at least two weeks for review of each submittal and re-submittal.

C. Electronic: Submittals shall be complete in one PDF file with bookmarks for each Specification Section. Multi-file submittals will be returned without review.
   1. First Page: Name of Project, Owner, Location & Contracting Company.
   2. Index Page: List of specification sections with contents by Tag or item.
   3. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

D. Clearly indicate on each page the equipment schedule designation (Tag) and/or specification section, as applicable. Indicate selected model and all accessories intended for use.

E. Equipment vendor cover page with contact information shall precede submittal by that vendor.

F. Submitted product information shall include (as applicable) but not be limited to the following information:
   1. Product description.
   2. Manufacturer and model.
   3. Dimensions.
   4. Performance Ratings.
   5. Construction Materials.
   6. Ratings (i.e. UL, ASTM, NEMA, etc).
   7. Engineering technical data.
   8. Electrical characteristics (Voltage, Phase, Wattage, Breakers, etc).
   9. Controls and wiring diagrams.
   10. Accessories.

G. If requested in subsequent Specification Sections or by Architect or Engineer, submit Manufacturer's Installation Instructions on any equipment, procedures, or certifications so requested.

H. Do no ordering, fabrication or manufacturing of products until return of approved submittals.

I. The Contractor agrees to pay for the Engineer's review cost of the Fire Alarm Systems Submittals beyond one resubmittal where resubmittals are required due to deficiencies in the Contractor's Submitted material.

1.10 SHOP DRAWINGS

A. The Contractor shall prepare Shop Drawings stamped and signed by a Certified Designer. Drawings shall be developed in accordance with Code and the State and Local Fire Marshals. Submit PDF copies of these drawings for approval prior to beginning work.

B. Submit shop drawings to Architect, Local Fire Marshal, and all other approving authorities. Drawings shall be approved by all agencies prior to fabrication or installation. Drawings submitted for Architect's approval shall have been stamped approved by the Fire Department.

C. The Contractor shall draw the design team's attention to any areas in which they contemplate deviations from the conceptual information shown on the contract documents (e.g., due to site conditions).

D. These drawings and diagrams shall show the manufacturer's name and catalog number of each piece of equipment used. Also included shall be:
1. Symbols and legend sheet.
2. Schedules sheets.
3. Floor Plans showing device locations per Code and Fire Marshal requirements.
4. Wiring diagrams.
5. All calculations required for approval by the Fire Marshal and local AHJ.

E. The Contractor shall also coordinate with the General Contractor and provide slab plans marked up with all penetrations required for fire alarm and area of refuge systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.

F. The Architect's and Engineer's review of shop drawings shall not relieve the Contractor of responsibility for deviations from the Contract drawings or specifications, unless he has, in writing, called the attention of the Architect to such deviations at the time of the submission, nor shall it relieve him from responsibility for errors or omission in such shop drawings.

1.11 ESDS RELATED DOCUMENTATION AND ACTIVITIES

A. Provide commissioning documentation per EA Prerequisite 1 and as the Commissioning Authority (CxA) requests.

B. Comply with IAQ Management Plan by the general contractor.

C. Submit the ESDS VOC Form, for any VOC-containing material to be used inside the building envelope, including materials for patching, touch-up and cleaning

D. Construction Waste Management: Retain and submit all trip and tip tickets for all construction debris and waste removed from site, indicating material content, tonnage, date hauled and facility to where materials were hauled. This submittal is to the general contractor only.

1.12 PERMITS

A. In addition to the distribution requirements specified in other Specification Sections, the Fire Alarm Design-Build Contractor shall make all required submissions to the Authorities Having Jurisdiction (AHJ) for Permits and approval. The Fire Alarm Contractor shall pay all fees related to said submissions. The Fire Alarm Contractor shall revise their design and resubmit as needed to obtain AHJ approval. All additional and / or revisions to the Fire Alarm Contractor's designs required to obtain AHJ approval shall be carried out by the Fire Alarm Contractor at no additional cost to the Owner – this includes the fees associated with any resubmissions. The Fire Alarm contractor shall submit all comments received from the AHJ to the Architect and Engineer.

B. The Contractor shall not commence work until a permit (or "get started" permit where allowed by the AHJ) is obtained. Contractor is solely responsible for ensuring that the permit application and any revisions are submitted in a timely manner so as not to impact project schedule.

1.13 QUALITY ASSURANCE

A. Perform all work per current versions of all applicable Code and Standards with state and local amendments – see "Codes and Standards" paragraph above.

B. All equipment and devices shall be UL-Listed and Labeled and shall be acceptable to the Authority Having Jurisdiction as suitable for the use and location for which they are intended.

C. Provide all system components from one manufacturer unless Architect provides written permission to do otherwise.

1.14 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in Specification Sections 28 46 00 and 28 46 21 with a minimum of five years' experience.

B. Installer: Company specializing in performing Work on projects of similar type and scale with a minimum of three years' experience.

1.15 SCHEDULING

A. Coordinate with and provide assistance in final adjustment and testing of life safety systems with the General Contractor and Fire Authority.

1.16 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. The Contractor shall keep all equipment, devices, conduit, etc in a dry, protected area. The location shall be coordinated with the Architect and General Contractor prior to the start of Construction. See Division 01 for additional delivery, storage and handling requirements.

C. Where original packaging is insufficient, provide additional protection. Maintain protection in place until installation.

D. Inspect all products and materials for damage prior to installation.

E. Protect conduit from all entry of foreign materials by providing temporary end caps or closures on conduit and fittings.

F. Protect materials and finishes during handling and installation to prevent damage.

G. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

1.17 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fire stopping materials when temperature of substrate material and ambient air is below 60 degrees F. Maintain this minimum temperature before, during, and for minimum 3 days after installation of fire stopping materials.

B. Coordinate with General Contractor to have ventilation provided in areas to receive solvent cured materials.

C. Do not install underground conduit when bedding is wet or frozen.

1.18 FIELD MEASUREMENTS

A. Verify field measurements prior to ordering gear.

B. Verify by field measurements that equipment sizes and configurations are compatible with wall construction and layout.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining and documenting exact locations of existing systems.

1.19 COORDINATION

A. The Contractor shall visit the site and become familiar with existing conditions affecting work. The Contractor shall include in their Bid the costs for all work and / or materials required to comply with the requirements of the Contract Documents based on the actual existing conditions. Failure to visit the Site and verify actual existing conditions does not relieve the Contractor of these requirements; no change orders will be paid due to lack of verification of existing conditions whether they are specifically noted in the Contract Documents or not.

B. The Contractor shall verify the locations of any overhead or buried utilities on or near the Project site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.

C. Existing systems and utility lines indicated on drawings are in accordance with information furnished to the Architect and may not be complete. Contractor is responsible for locating, uncovering, disposing of or maintaining existing systems.

D. Where the word ‘verify’ is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner.

E. Where the drawings or specifications call out for the contractor to field verify and / or coordinate locations and requirements this verification / coordination is to be completed prior to any equipment, devices, supports, conduits, etc are installed / roughed-in. Any equipment, devices, supports, conduits, etc installed at locations unacceptable to the design team (either for aesthetics or functionality) due to the contractor failing to field verify / coordinate shall be relocated at the contractor's expense.

F. Electrical and Low Voltage Systems drawings are diagrammatic and do not indicate all possible site conditions. The contractor shall verify all measurements, dimensions and connections on site and coordinate between trades to preclude interferences. The contractor shall provide adjustments as necessary to fit actual conditions.

G. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or equipment roughed in improperly and not positioned on implied centerlines or as required by good practice shall be repositioned at no cost to the Owner.

H. In the event of a conflict with other trades of work, the following priority from highest to lowest shall be followed: Structural, lighting, HVAC, plumbing/piping and sprinklers. Starting with the lowest priority, the Electrical, HVAC, plumbing, and sprinkler

contractors shall provide whatever materials, offsets, labor etc. is required to resolve the conflict.

I. Advise the Architect of any modifications required to suit the equipment furnished. Costs for modifications due to equipment substitution will be borne by the contractor.

J. When discrepancies occur between plans and specifications, the Architect will determine which takes precedence and the Contractor shall perform the selected requirement at no additional cost.

K. Wherever conflicts occur between different parts of the Contract Documents the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

L. Coordinate trenching, excavating, bedding, backfilling of buried systems with requirements of this specification.

M. Coordinate wall openings, rough-in locations, and conduit rough-in locations to accommodate Work of Specification Sections 28 46 00 and 28 46 21.

N. Coordinate all equipment with building control work.

O. The Contractor shall coordinate with the Architectural plans and Project structure when locating equipment and devices and routing conduit and cabling.

P. The Contractor shall coordinate with the General Contractor and provide slab plans marked up with all penetrations required for electrical, fire alarm and low voltage systems. Sizes of penetrations shall be indicated on the plans and penetration locations shall be dimensioned from major building lines. The Contractor shall submit these slab plans to the Architect for review.

Q. The Contractor shall coordinate conduit and cabling routing and equipment and device locations with all other trades to ensure all Code required clearances are maintained and equipment and devices remain accessible after the work of all trades is complete.

R. The Contractor shall consult the approved shop drawings of all other trades and crafts to ensure coordination with final locations of cabinetry, counters, appliances, equipment, structural members, etc. Conflicts are to be resolved with the Architect and General Contractor prior to rough-in. The Contractor shall not be paid for relocation work (including cutting, patching, and finishing) required due to a lack of coordination prior to installation.

S. Prior to the start of Construction, coordinate locations and connection requirements for all line voltage power connections with the Electrical Contractor and Engineer.

1.20 PROJECT CLOSEOUT

A. Completion, submission and approval of the following is required for final project closeout:
   1. Walk through the Project with the Owner and Architect to make note of deficiencies.
   2. Execution of Owner's, Architect's and Engineer's final observation reports (punchlist).
   3. Operating and Maintenance Instructions.
   4. Operating and Maintenance Manual.
   5. Equipment Cleaning.
   6. Record Drawings and set of plans stamped approved by Fire Marshal.
   7. Testing.
   8. Commissioning.
   9. Warranty.

B. See Division 01 for additional requirements for the fire alarm system.

C. See other Divisions 26, 27 and 28 Specification Sections for complete project requirements.

1.21 OPERATING AND MAINTENANCE INSTRUCTIONAL TRAINING

A. General: In addition to requirements of Division 01, following initial operation of Electrical systems and prior to acceptance by the Architect, perform the following services:
   1. At least two weeks prior to each instruction period, give written notification of readiness to proceed to the Architect and Owner, and obtain mutually acceptable dates.
   2. Conduct demonstrations and instructions for the Owner's representatives, pointing out requirements for operating, servicing and maintaining equipment and systems. Describe general system operation and specific equipment functions. Cover all equipment calibration, lighting controls setpoint adjustment, safeties and alarms.
   3. Furnish qualifications of Contractor's personnel in charge of the instruction; foreman position is minimum acceptable. Where system startup is performed by supplier's or manufacturer's personnel, those personnel should also provide training on that equipment.
   4. During demonstrations and instructions include and reference information from maintenance manuals and contract drawings.
      a. Provide documentation of all instruction which includes:
         1) Date and time of instruction.
         2) Name, affiliation and qualifications of the instructor.
         3) Name and affiliation of the attendees.
         4) Topics, systems, and equipment covered.
         5) Length of instruction.
   5. Minimum duration of instruction periods:

a. Fire Alarm Systems 2 hours

1.22 OPERATING AND MAINTENANCE MANUALS

A. Contents: Furnish, in accord with Division 1, one PDF and one bound copy of operating and maintenance manuals to include the following:

1. The Job name and address.
2. Names, addresses and telephone numbers of the Contractor, sub- contractors and local companies responsible for maintenance of each system or piece of equipment.
3. Manufacturers, suppliers, contractor names, addresses and phone numbers.
4. Written guarantees.
5. Warranty service contractors' names, address and phone numbers (if different from above).
6. Copies of approved brochures and Shop Drawings as applicable for all submittal items.
7. Manufacturer's printed operating procedures to include start-up and routine and normal operating instructions; and control, shutdown, and emergency instructions.
8. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; and adjusting instructions.
9. Part numbers of all replaceable items.
10. Operation sequences.
11. Record drawings corrected and completed.
12. Completed equipment start-up forms and checklists.
13. Final copy of testing reports.

B. Operation and Maintenance Data:
1. Include spare parts lists for all equipment as applicable.
2. Submit installation instructions, adjustment instructions, and spare parts lists for all equipment.
3. Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
4. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

C. Binders:
1. Furnish typewritten or printed index and tabbed dividers between Specification Sections and principal categories.
2. Bind each manual in a hard-backed loose-leaf binder.
3. Imprint on Cover:
   a. Name of Project.
   b. Owner.
   c. Location of project.
   d. Architect.
   e. Contractor.
   f. Year of Completion.

4. Imprint on backing:
   a. Name of Project.
   b. Year of completion.

D. PDFs:
1. Provide PDF with bookmarks for each Specification Section and Principal Category.
   a. First Page: Name of Project, Owner, Location & Contracting Company.
   b. Index Page: List of specification sections with contents by Tag or item.
   c. Bookmarks: Electronic bookmark of each specification section corresponding to listing in index.

E. Submittal:

1. Preliminary Copies: Prior to scheduled completion of the project, submit one PDF copy for review by the Architect.

2. Final Copies: After approval of the preliminary copy, submit one PDF and one bound copy to the Owner.

1.23 RECORD DRAWINGS

A. Prepare record documents in accordance with the requirements of Division 01 Specification Section "Contract Closeout."

B. Label each drawing as "Record Drawing" with Electrical Contractors' name and date.

C. During construction, maintain an accurate record set of the drawings of the installation on project site at all times; keep this set in a safe location, protected from the environment.

D. Submit one digital file with all drawings in PDF format.

E. Make all notes and revisions on PDF set in red.

F. In addition to the requirements specified in Division 01 and in other Division 26, 27 and 28 Specification Sections, indicate installed conditions (locations, sizes, burial depths, arrangements, etc) for:
1. Equipment locations (exposed and concealed) shown to scale and dimensioned from prominent building lines.
2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.24 TESTING

A. Perform testing of fire alarm systems as described in this Specification and as required by applicable codes and ordinances.

B. Written verification of testing to be signed by Owner's Representative.

C. Perform testing of fire alarm and area of refuge / two-way call systems as required by applicable codes and ordinances.

1.25 WARRANTY AND CONTRACTOR'S GUARANTEE

A. All work, material and equipment shall be free of defect, complete and in perfect operating order at time of delivery to Owner.

B. The Contractor shall, without cost to the Owner, correct all defects and failures discovered within one year from date of final acceptance for all electrical, fire alarm and low voltage systems, except when in the opinion of the Architect a failure is due to neglect or carelessness of the Owner.
   1. See individual Specification Sections for additional requirements.

C. The guarantee of the Contractor is independent of shorter time limits by any manufacturer of equipment furnished. Submit with Operation and Maintenance Manual all guarantees which exceed one year.

D. The Contractor shall make all necessary adjustments during first year of operation.

E. The presence of any inspector or observer at any point during construction does not relieve the Contractor from responsibility for defects discovered after completion of the work.

F. Refer to Division 01, 26, 27 and 28 Specification Sections for additional Warranty requirements.

PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEM:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. FACP and Equipment:
      a. Edwards Systems Technology.
      b. Notifier; a Honeywell Company.
      c. Silent Knight; a GE-Honeywell Company.
      d. Simplex Grinnell.
      e. Any Alternate Manufacturers must be submitted during the Bid Process for review and approval by the Owner, Architect and Engineer. No Alternates will be accepted after Bid.
   2. Wire and Cable:
      a. Comtran Corporation.

b. Helix/HiTemp Cables, Inc.; a Draka USA Company.

c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.

d. West Penn Wire/CDT; a division of Cable Design Technologies.

3. Audible and Visual Signals:
   a. Edwards Systems Technology.
   b. Gentex Corporation.
   c. Silent Knight; a GE-Honeywell Company.
   d. Simplex Grinnell.
   e. System Sensor; a GE-Honeywell Company.
   f. Any Alternate Manufacturers must be submitted during the Bid Process for review and approval by the Owner, Architect and Engineer. No Alternates will be accepted after Bid.

2.2 NON-SYSTEM FIRE ALARM DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

1. Kidde United Technologies.

2.3 HANGERS AND SUPPORTS

A. See Specification Section 26 00 01.

2.4 GROUNDING AND BONDING

A. See Specification Section 26 00 01.

2.5 RACEWAY AND BOXES

A. See Specification Section 26 00 01.

2.6 IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. See Specification Section 26 00 01.

PART 3 EXECUTION

3.1 DOCUMENTATION

A. Additional plan submittals to reviewing authority: If additional drawing submittals are required at any time during construction the Contractor shall submit drawings, review with authority, and pick up subsequent approved drawings. The Fire Alarm Contractor will revise and/or prepare drawings for submittal.

3.2 MOCK-UPS

A. The Contractor shall completely mock-up one of each typical unit type, the offices and the common areas (exact units and areas to be chosen by the Architect and Owner) by marking the intended locations of all fire alarm systems equipment and devices.

B. Before starting installation of equipment and devices, the Contractor shall walk through all mocked-up areas with the Owner, Architect, and General Contractor to receive approval for all locations.

C. The Contractor shall relocate equipment and devices in the mock-ups per the Owner and Architect's instructions.

D. The Contractor shall relocate any equipment and devices installed prior to the approval of the mocked-up areas by the Architect and Owner at the Electrical Contractor's expense.

3.3 SURFACE PREPARATION

A. Examine areas and equipment for conditions that would affect performance of the Work. Proceed with installation only after unsatisfactory conditions have been addressed.

B. Degrease and clean surfaces of any matter that would affect the bond of paint, adhesives or firestopping material.

C. Remove incompatible materials affecting bond of paint, adhesives or firestopping.

D. Degrease and clean surfaces to receive adhesive for identification materials.

E. Obtain permission from Architect before drilling or cutting structural members.

F. For adhesive anchors, clean holes and prepare per manufacturer's instructions prior to installation.

3.4 INSTALLATION

A. The Contractor shall conceal all conduit, cabling and boxes in finished areas unless indicated otherwise or granted specific permission by the Architect. Install all conduit and cabling perpendicular to or parallel with building lines wherever possible.

B. In open ceiling areas, all cabling shall be installed in conduit. In front of house (public) areas, conduit shall be painted; color as selected by the Architect.

C. Coordinate the locations of equipment and devices with all other trades.

D. FIRE ALARM DEVICES:
   1. Coordinate all locations with Architect and all other trades.

2. No fire alarm devices are to be located above any cove heaters. Any fire alarm devices so located shall be moved at the Contractor's expense.
3. Smoke or Heat Detector Spacing:
   a. Smooth ceiling spacing shall not exceed the rating of the device.
   b. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
4. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
5. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
6. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
7. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
8. Visible Alarm-Indicating Devices (where required): Install adjacent to each alarm horn and at least 6 inches (150 mm) below the ceiling.
9. Device Location-Indicating Lights: Locate in public area near device they monitor.
10. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

E. FIRE ALARM SYSTEM WIRING
1. Install wiring according to the following:
   a. NECA 1.
   b. TIA/EIA 568-A.
   c. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
   d. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
   e. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating

circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. HANGERS AND SUPPORTS
1. See Specification Section 26 00 01.

G. VIBRATION AND SEISMIC CONTROLS
1. See Specification Section 26 00 01.

H. GROUNDING AND BONDING SYSTEMS
1. See Specification Section 26 00 01.
2. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

I. RACEWAY AND BOXES
   1. See Specification Section 26 00 01.

J. IDENTIFICATION FOR ELECTRICAL SYSTEMS
   1. See Specification Section 26 00 01.
   2. Install instructions frame in a location visible from the FACP.

K. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.5 INSPECTION

A. Do not allow any work to be covered up or enclosed until inspected, tested and approved by the Architect and all authorities having jurisdiction over the work.

B. Should any work be enclosed or covered up before such inspection and test, the Contractor shall at his own expense uncover work, and after it has been inspected, tested and approved, make all repairs as necessary to restore all work disturbed by him to its original condition including paying other trades repair work under their scope that was disturbed.

3.6 FIELD QUALITY CONTROL

A. Initial Inspection: The Contractor shall inspect all equipment, devices, conductors, hangers, supports, cable, etc prior to installation to verify that they are: identified properly on the reel identification label, that it is of the proper gauge, that it contains the proper number of pairs, that there is no damage to the equipment/ devices, etc. Note any buckling of the jacket, which would indicate possible problems. Damaged cable, equipment, devices, etc or any component failing to meet specifications shall not be used in the installation.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
   1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
   2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
   3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

4. Testing: Follow procedure and record results complying with requirements in NFPA 72. Detectors that are outside their marked sensitivity range shall be replaced.
5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.7 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

B. Clean interior and exterior of all equipment. Equipment shall be free of dirt, construction debris, corrosion, etc.

C. Adequate provisions shall be made during construction to eliminate dirt, debris or other material from entering and collecting inside of conduit and equipment. Any collection of material shall be thoroughly cleaned before owner occupancy.

D. Clean exterior of all exposed conduit.

E. Use ESDS Compliant Products: Materials intended for use inside the building envelope, including those used for patching, painting, touch-up, and cleaning, must contain acceptable levels of VOC's and contain no added urea-formaldehyde.

3.8 CUTTING, FITTING, REPAIRING AND PATCHING

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where necessary for installation of fire alarm systems work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting where possible by setting sleeves, frames, etc., and by coordinating for openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for fire alarm systems installations.

C. Cut all holes neatly and as small as possible to admit work. Perform cutting in manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.9 SALVAGE

A. Remove excess conduit and conductors. Remove scrap and all other excess materials from the site.

B. Comply with contractor's Construction Waste Management Plan. Retain and submit all trip and tip tickets for all construction debris and waste hauling, indicating material content, tonnage, date hauled and facility to where materials were hauled.

3.10 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

# SECTION 31 11 00

# SITE PREPARATION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Provide temporary erosion and sedimentation control facilities.
   2. Remove site vegetation including all noxious and invasive weeds within areas to be cleared for new construction and as indicated on plans.
   3. Remove curbs, fencing/railings, pavement, and all miscellaneous other items as required to construct new improvements.
   4. Grub and remove materials from below the ground surface within areas to be cleared for new construction.
   4. Dispose of materials off site.
   5. Identify, coordinate with utility Owner, disconnect, cap and remove utilities as required.
   6. Protect from harm any trees or other objects to remain.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:
   Section 01 57 00 - Temporary Facilities and Controls
   Section 01 71 23 - Field Engineering
   Section 31 20 00 - Earthwork

### 1.3 REFERENCES

| | |
|---|---|
| WSDOT | 2022 Standard Specifications for Road, Bridge, and Municipal Construction. |
| KCSWDM | 2016 King County Surface Water Design Manual |

### 1.4 SUBMITTALS

A. Provide all monitoring, sampling, testing, reporting, documentation, and coordination required by the City of Kirkland permit coverage.
B. Submit manufacturer’s data on all proposed TESC materials. Submit all required documentation to permitting authorities for all proposed TESC processes, equipment, and materials.

### 1.5 DESCRIPTION

A. Design and construct erosion and sedimentation control in accordance with the Kirkland and KCSWDM requirements, except as modified herein. Clear, strip, and grub portions of site to receive improvements. Save and protect from all harm any trees or other objects to remain. Remove all other growth from area to be cleared, unless otherwise indicated or directed. Remove existing improvements, including but not limited to utilities, paving, slabs, and walkways as indicated on plans and as

directed by the Owner. Perform work incrementally as necessary to minimize areas of exposed soils and avoid exposure of bare soils to precipitation.

1.6 EXISTING CONDITIONS

A. Protection of Existing Improvements: Provide, erect, and maintain barricades, coverings, or other types of protection necessary to prevent damage to existing improvements to remain. Restore any site improvements to remain that are damaged by work of this contract, including but not limited to landscaping, pavement, walks, structures, fences, and utilities, to their original or better condition, as acceptable to Owner.
B. Contact utility companies and request meter readings, utility cutoffs, and meter and line removals. Verify that all appropriate services have been disconnected. Contractor shall pay for all fees and costs associated with utility disconnects, capping, and line and meter removals.
C. Do not shut off or cap utilities without prior notice. Utilities shall remain in service unless otherwise directed or indicated. Coordinate work with Division 1 requirements. Maintain drains and sewers open for free drainage. Provide all means necessary to prevent damage to existing utilities to remain, including but not limited to monitoring, steel plating, vehicular load restrictions, and any other measures required for preservation and protection.
D. Objectionable Noises: Limit use of air hammers and other noisy equipment. Conform with local governing requirements regarding noise control.
E. Maintain vehicular and pedestrian traffic routes:
    1. Do not close or obstruct streets, parking lots, access drives, fire lanes, sidewalks, alleys, or passageways without permission from authorities having jurisdiction.
    2. Coordinate with governing authorities and provide alternate routes around closed or obstructed traffic ways.

1.7 DIMENSIONS AND LAYOUT

A. The Contractor is responsible for furnishing, setting, and marking all line, location, and layout stakes.
B. The Contractor is responsible for deriving layout information from an AutoCad file provided for this purpose.

## PART 2 - PRODUCTS

2.1 EROSION CONTROL PRODUCTS

A. All products utilized for erosion control shall be in conformance with KCSWDM and the details in the drawings.

## PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify clearing and grubbing and site improvement removal may safely and appropriately begin.
B. Obtain required use permits and permission from local governing authorities and

Owner prior to commencing work. Arrange with City inspector for erosion control inspection at the beginning of the project.

3.2 EROSION CONTROL

A. Design, construct, maintain, upgrade, and adjust the erosion control system in accordance with the drawings and Contractors' operations in order to maintain compliance with all project permits and approvals. Pay for all costs associated with the design, construction, maintenance, upgrading and adjustment of the erosion control system throughout project duration.
B. Procure all permits and approvals required for handling of stormwater discharges from the site during construction. Provide all equipment, materials and labor necessary to meet all permit requirements related to construction stormwater or groundwater discharge from the site, including but not limited to storage, filtration, pumping, sampling, and testing.
C. Provide all compliance actions required by KCSWDM and Kirkland permit coverage, including but not limited to permit acquisition for Contractor-designed systems, monitoring, sampling, testing, reporting, documentation, and coordination with the City of Kirkland and KCSWDM as required. A qualified Construction Erosion Sediment Control Lead (CESCL) familiar with erosion control BMPs must be assigned to the Contractor's crew for this work and shall be on site at all times when TESC work is being performed, together with all necessary equipment, supplies and instruments related thereto.
D. Access Streets and Roadways: Provide necessary TESC measures to prevent track-out from the site onto public streets or walkways. If/as necessary, provide wheel cleaning facilities to clean wheels and undercarriage of trucks before leaving site, to prevent dirt from being carried off-site. If streets are fouled, clean immediately in conformance with AHJ and all governing requirements and regulations.
E. Provide catch basin protection between frame and grate of existing catch basins in and adjacent to work area. Provide catch basin protection between frame and grate of new catch basins and area drains following installation, until site paving is completed.
F. Provide stockpile covering in accordance with Section 31 20 00.
G. Provide temporary cover measures to prevent direct exposure of bare soils to precipitation. Approved cover methods are as noted above for stockpiles, and/or mulching (straw or wood fiber cellulose), erosion control blankets, clean crushed rock, and hydroseeding. Straw mulch shall be applied uniformly to provide a minimum in-place thickness of 3". Wood fiber cellulose shall be applied uniformly to provide 30 lbs/1000 SF.
H. Remove all TESC facilities at completion of work and subsequent to final stabilization of contributing drainage area served by each facility.
I. Immediately stabilize areas of exposed soils on-site or off-site, that will not be disturbed for two days during the wet season or seven days during the dry season, with an approved TESC cover method (e.g., seeding, mulching, plastic covering, etc.)

3.3 TREE AND SHRUB PROTECTION

A. Preserve and protect existing trees and vegetation which are outside areas to be cleared or indicated to be protected.

3.4 CLEARING

A. Remove trees, underbrush, and all vegetation within areas to be cleared as noted. Perform removal operations in a manner to protect adjacent property and improvements to remain.
B. Save and protect trees within tree protection areas. Protect all off-site trees to remain along adjacent roadways and on surrounding properties throughout duration of project construction. Repair/replace damaged trees as required.

3.5 STRIPPING TOPSOIL

A. Strip full depth of topsoil within areas to be cleared.

3.6 GRUBBING

A. General: Grub areas within areas to be cleared.
    1. Excavate and remove all stumps (if encountered in the work area) to a depth of 2 feet below proposed or existing grade, whichever is lower.
    2. Excavate and remove roots 1-1/2 inches in diameter and larger, rocks, boulders, and the like, as well as other objectionable materials to a depth of 2 feet below proposed or existing grade, whichever is lower.

3.7 SITE IMPROVEMENT REMOVALS

A. Completely remove and dispose of pavement, structures, fences, culverts, and other obstructions, unless indicated to be saved. Break up, load, and dispose of pavements. Take care in removing pavement, structures, and all other items that damage does not occur to existing improvements which are to remain in place. Make a neat vertical saw cut at the boundaries of all areas to be removed. Sawcut all concrete walk removals at the next adjacent score line or remove to the nearest joint. Replace adjacent materials designated to remain that are damaged due to Contractors' operations, at no additional cost to the Owner.
B. At locations to be paved, remove underground structures to a depth of 2 feet below existing or final grade, whichever is lower. At locations to be landscaped, remove underground materials other than soil to a depth 3 feet below existing or final grade, whichever is lower.
C. Slabs and underground structures to be abandoned in place shall be fully fractured into a suitable number of pieces to allow for water passage to underlying materials and prevent hydrostatic buildup above or below the slab.
D. Sprinkle excavated material and access roads as necessary to limit dust to lowest practicable level. Do not use water to such an extent that is causes flooding, contaminated runoff, or icing.
E. Remove all underground piping and utility structures designated for removal. All piping to be abandoned in place shall be fully plugged with cement concrete at each end, to a distance of 3 ft inbound from each exposed pipe end.
    1. Repair damage to existing utilities to remain, at Contractor's expense.
    2. In the event the Contractor encounters utility lines not shown on the site plan or otherwise indicated to be saved, removed, or abandoned, the location of such lines shall be marked in the field and the Architect/Engineer notified.
    3. In the event the Contractor encounters Asbestos Concrete Pipe, Contractor shall secure all permits and provide all measures required for working with and disposing of Asbestos Concrete Pipe, in accordance with all applicable laws and regulations.

3.8 DRAINAGE

A. Keep on-site and off-site drainage systems open for drainage at all times. Remove mud/sediment build-up and do not flush it into the downstream system. If sediment is discharged to on-site or off-site drainage systems, clean such systems of all debris and sediment.
B. Keep open pits and holes caused as a result of demolition work free of standing water.

3.9 FILLING DEPRESSIONS

A. Fill depressions caused by clearing, grubbing, demolition, and utility removal operations with compacted imported structural fill material unless further excavation or earthwork is indicated. Imported structural fill material shall be placed and compacted in accordance with Section 31 20 00.

3.10 DISPOSAL OF MATERIALS

A. Dispose of material off site in a manner consistent with all government regulations. In no case shall material be left on the project site, shoved onto abutting private properties, or buried in embankments or trenches on the project site. Do not deposit debris in any stream or body of water, or in any street or alley, or upon any private property except by written consent of the private property owner. Maintain hauling routes clean and free of any debris resulting from work of this Section.

END OF SECTION

# SECTION 31 20 00

# EARTHWORK

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Accomplish indicated and required excavation, filling, backfilling, compaction, subgrade preparation, rough and finish grading, and all other earthwork above design subgrades.
   2. Remove unsuitable soil below design subgrade as required and in accordance with this Section.
   3. Import Structural Fill below design subgrade as required and in accordance with this Section.
   4. Provide required imported materials.
   5. Provide trenching, excavation, bedding, and backfilling for utilities and utility structures.
   6. Remove materials from the site if they are either not approved for reuse, or they are in excess of that required.
   7. Coordinate earthwork operations and requirements with other work of the project.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Specifications, including but not limited to following:
   Section 01 57 00 - Temporary Facilities and Controls
   Section 01 71 23 - Field Engineering
   Section 31 10 00 – Site Preparation

### 1.3 REFERENCES

| | |
|---|---|
| KCSWDM | 2016 King County Surface Water Design Manual |
| WSDOT | 2022 Standard Specifications for Road, Bridge, and Municipal Construction. |
| ASTM D1557 | Methods of Test for Moisture-Density Relations of Soils, Using 10 lb (4.5 kg) Rammer and 18 In. (457 mm) Drop |
| ASTM D2922 | Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods. |
| DOE | 2019 WA State Department of Ecology Stormwater Management Manual for Western Washington |

### 1.4 SUBMITTALS

A. Submit product information for all imported materials to be used at least 30 days in advance of use. Identify the supplier of the imported material, and

provide a certified gradation curve from an established testing agency demonstrating compliance with the specified gradation. Testing for compliance shall have been performed no more than 4 months prior to the date of submittal.

1.5 QUALITY ASSURANCE

A. Testing for benefit of Owner:
   1. Owner's Geotechnical Engineer will take samples and perform moisture content, gradation, compaction, and density tests during placement of fill and backfill materials to check compliance with these Specifications, for the benefit of the Owner.
   2. Remove material at locations designated by the Geotechnical Engineer and provide assistance as necessary for sampling and testing.
   3. The Geotechnical Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated materials to determine that the Contractor has complied with these Specifications.
   4. Tests will be made by an outside Testing Agency for the following items, but not limited to:
      a. Moisture content - ASTM D3017
      b. Gradation - ASTM C136, ASTM D422
      c. Density in-place - ASTM D2922, or equivalent.
      d. Moisture-density relationships - ASTM D1557

B. Contractor is responsible for performing any and all testing necessary for their own verification of proper compaction.

1.6 DEFINITIONS

A. Compaction: The degree of compaction is specified as percent compaction. Maximum or relative densities refer to dry soil densities obtainable at optimum moisture content.
B. Excavation slope: Defined as an inclined surface formed by removing material from below existing grade.
C. Fill slope: Defined as an inclined surface formed by placement of material above existing grade.
D. Unsuitable soil: Unsuitable soil is defined as soil not meeting the requirements for structural fill per paragraph 2.1 of this Section. Structural fill material that is outside the range of optimum soil moisture content at the time of excavation may not necessarily be considered unsuitable soil; moisture conditioning may help lower the moisture content to a point where it can be suitable.
E. Design Subgrade: The following shall define the design subgrade:
   1. Areas of proposed fill: The elevation of existing grade following clearing, grubbing, and stripping operations.
   2. Foundations and Footings: The elevation of existing grade following clearing, grubbing, and stripping operations, or the bottom of the foundation or footing, whichever is lower.
   3. Building Slab on Grade: The elevation of existing grade following clearing, grubbing, and stripping operations, or the bottom of the imported structural fill subbase under the slab on grade, whichever is lower.

4. Walkways and Paving: The elevation of existing grade following clearing, grubbing, and stripping operations or the bottom of the imported granular materials comprising the paving section, whichever is lower.
5. Utility Trenches and structures: The elevation of existing grade following clearing, grubbing, and stripping operations, or the bottom of the utility/structure bedding material, or bottom of structure if not bedded, whichever is lower.
6. Landscaped Areas: The elevation of existing grade following clearing, grubbing, and stripping operations, or the bottom of the proposed topsoil or amended soil section, whichever is lower.

F. Utility: In-ground utility facilities, including but not limited to storm drainage, potable water, irrigation, sanitary sewer, plumbing, gas, and electrical improvements, piping, conduits, raceways, structures, handholes, and vaults.

1.7 BASE BID WORK

A. Include in Base Bid the cost of achieving the design subgrades and finish grades defined by the Contract Documents, beginning with the existing conditions. Base Bid work comprises all work related to subgrade preparation as well as all work above design subgrade and the catch slope surfaces extending from there, including but not limited to excavation, moisture conditioning and other soil preparation, segregating, stockpiling, protecting, filling, backfilling, import of materials, hauling, removal of unsuitable material, removal of excess and non-approved material, and disposal.
   1. The Contractor is responsible for preparing on site material for reuse, including but not limited to segregating, moisture conditioning, amending, and treating, or shall remove such material. Such removed material shall be replaced with imported structural fill.
   2. The Contractor is responsible for removing material, including previously approved material, that is deemed not approved at the intended time of use. Such removed material shall be replaced with imported structural fill.

1.8 DIMENSIONS AND LAYOUT

A. All layout shall be provided by the Contractor. See Paragraph 31 10 00 - 1.7.
B. Preserve all benchmarks and stakes and replace any that are displaced or missing.
C. Review all records relating to existing underground utilities. Avoid damage to these facilities and restore all utilities damaged by the Contractor’s operations at its own expense.
D. Notify the Engineer immediately of underground utilities encountered that are not shown on the plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: All materials shall be naturally occurring. No recycled materials are allowed.

B. Material for making fills shall be suitable on-site material or imported structural fill.

C. Bedding material for utilities other than gas, electrical and communications shall be crushed surfacing top course per WSDOT Section 9-03.9(3).

D. Bedding material for gas, electrical, and communications shall be Class 2 fine aggregate per WSDOT/APWA Section 9-03.1(2).

E. Material for utility trench backfill shall be imported structural fill.

F. Material for utility structure backfill shall be imported structural fill.

G. Suitable on-site material: Excavated on site granular soils cleaned of organic and deleterious materials and rocks or clumps greater than 6 inches in overall dimension. Moisture content of suitable on-site material at the time of placement shall be such that the specified compaction can be readily attained.

1. On-site material may be moisture sensitive and may be over optimum moisture at the time of excavation. The Contractor is responsible for preparing on-site material for reuse, including but not limited to segregating, moisture conditioning, and amending, or shall remove such material. Such removed material shall be replaced with imported structural fill.
2. On-site material suitability will be influenced by the weather conditions and the Contractor's handling and protection of the material. The Contractor is responsible for removing material, including previously approved material, that is deemed unsuitable at the intended time of reuse and replacing with suitable imported structural fill.

H. Imported structural fill: Clean, naturally occurring, granular, well-graded sand and gravel materials from offsite sources, free of organic or recycled material, debris, and other deleterious material. Imported structural fill shall conform to the following gradation requirements:

| U.S. Standard Sieve Size | Percent Passing by Dry Weight |
|---|---|
| 3 inch | 100 |
| 3/4 inch | 50 - 100 |
| No. 4 | 25 - 65 |
| No. 10 | 10 - 50 |
| No. 40 | 0 - 20 |
| No. 200 | 0 – 5 |

I. Provide amended soil in landscaped areas in accordance DOE BMP T5.13, and KCSWDM requirements.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENT CONTROL

A. All work shall conform to the Contract Documents and applicable permits.

3.2 PROTECTION OF EXISTING FACILITIES

A. Utilities: Protect from damage all private and public utilities in accordance with 1-07.17 of WSDOT.
B. Pavement: Protect from damage all paved or graveled areas intended to remain.
C. Access Streets and Roadways: Follow requirements of Section 31 10 00. Provide and maintain wheel cleaning stations to clean wheels and undercarriage of trucks before leaving site, as necessary to prevent dirt from being carried onto public streets. If streets are fouled, they must be cleaned immediately in conformance with City of Kirkland and all governing requirements and regulations.
D. Repair and/or replacement of damaged facilities will be accomplished at the Contractor's expense.

3.3 EXCAVATION, FILL, AND BACKFILL

A. General:
    1. Provide excavation of whatever nature required for construction of the work. Verify character, quality, and disposition of material to be excavated prior to starting. Blasting will not be permitted.
    2. Shallow groundwater may be encountered on site. Contractor is responsible for designing, providing, maintaining, upgrading, and adjusting dewatering systems as required to keep excavations free from water. Contractor is also responsible for obtaining all permits and approvals required for their groundwater discharges to storm water and/or sanitary sewer systems during construction. Provide for all requirements related to such discharges, including but not limited to storage, filtration, pumping, sampling, testing, and reporting to AHJ.
    3. At the time of placement, fill and backfill material placed shall be within 2% of the material’s optimum moisture content.
    4. The Contractor is responsible for preparing on site material for reuse, including but not limited to segregating, moisture conditioning, amending, and treating, or shall remove such material if it cannot be reused. Such removed material shall be replaced with imported structural fill.
    5. The Contractor is responsible for removing material (including previously approved material) that is deemed not approved at the intended time of use. Such removed material shall be replaced with imported structural fill.
B. Trench Excavation:
    1. Excavation and preparation of the trench shall be in accordance with WSDOT Section 7-08.3(1).
    2. Excavate to depths allowing for required bedding.
    3. Grade and smooth bottom of trench to furnish uniform bearing and support for pipelines. Remove rocks and similar material causing point bearings.
    4. Form bell holes and depressions for joints after grading of trench bottom. Limit such depressions to lengths, depths, and widths required for particular type of joint.

C. Foundations and Footings:
   1. Grade and smooth subgrade to furnish uniform bearing and support. Remove rocks and similar material causing point bearings.
   2. Where bottom of foundation/footing is above bearing stratum, remove material below bottom of foundation/footing down to bearing stratum. Extend width of removal laterally from the sides of the foundation/footing a distance equal to the depth of the removal below the foundation/footing.
   3. Where bottom of foundation/footing is below bearing stratum, remove existing material to a depth of 1 ft below bottom of foundation/footing and replace with imported structural fill.

D. Fill and Backfill:
   1. All areas that are to receive fill or backfill shall be observed by the Geotechnical Engineer prior to the placement of any material. Where existing slopes exceed 25%, fill shall be keyed and benched into the existing slope. Horizontal width of each bench cut shall be a minimum of four feet into native soil and vertical depth of each bench cut shall be a minimum of two feet into native soil.
   2. Place and compact fill and backfill material in accordance with Paragraph 3.7 of this Section.
   3. Bedding for Utilities: Properly place material in trenches. Do not disturb sides of trenches. Compact and shape material to conform to the utility being installed to ensure continuous firm bedding for full length of utility.

## 3.4 SUBGRADE PREPARATION

A. Beneath pavement and structures: Scarify the design subgrade surfaces to a depth of at least twelve inches, unless noted otherwise. Moisture-condition the scarified soil to attain soil moisture content necessary for required compaction. Compact the scarified soil to 95% relative compaction per Paragraph 3.7 of this section. Prepared subgrades shall be proof-rolled with a loaded dump truck or heavy compactor to verify proper density.
B. Beneath landscaped areas: Scarify subgrade to a depth of at least 4 inches prior to placing amended soils.
C. Control grading to prevent flow of water into subgrade areas.
D. Protect and maintain subgrades and repair any deficient subgrades prior to placing any materials on subgrade surfaces.

## 3.5 STABILIZATION OF EXCAVATIONS AND TRENCHES

A. Exercise sound engineering and construction practices for excavations and trenches and maintain them so that no damage will occur to any foundation, structure, pole line, pipe line, utility, paving, or other facility because of sloughs or slopes, or from any other cause. If, as a result of the excavation or trenching, there is disturbance of the ground which may endanger such facilities or other property, or require repair, take remedial action at no expense to the Owner.

B. Provide dewatering, shoring, and any other types of stabilization, in addition to the shoring required for safety by State codes, as required to maintain the integrity of the trench or excavation and protect nearby existing utilities and structures. Ensure that earthwork activities conform to the Washington Administrative Code (WAC) 296-155 requirements for Excavation, Trenching, and Shoring. If the Contractor elects to provide stabilization by open pit excavation or flatter side slopes, no additional compensation will be made for the work including excavation, imported backfill material, backfilling, and protection and restoration of existing facilities.
C. Provide, erect, and maintain temporary support systems for existing utilities to remain during excavation work, or remove and replace utility and provide temporary bypassing during outage. Provide support systems that allow affected utility to remain in service during excavation and backfill work, and prevent any movement of the existing utility line.

3.6 SITE GRADING

A. Should indicated elevations or figures conflict with proposed improvements, notify Engineer immediately for direction. Grade to within 1/20 foot of specified elevations.
B. Control grading to prevent flow of water into excavated areas and ponding.
C. Remove all concrete, rocks, rubble, and debris larger than 1 inch on a side from subgrade in paving areas.
D. Grade to slopes indicated by proposed contours and elevations, and to provide positive drainage. Localized low spots and rises will not be allowed except as indicated. Provide slope rounding and uniform transitions between areas of different slopes.
E. Protect and maintain finished surfaces. Allow no heavy objects to be moved over finish grade surfaces. Repair any ruts or holes in finished surfaces, and any obstructions to positive drainage. Repair areas showing settlement.

3.7 COMPACTION

A. Water settling or jetting will not be permitted as a means of compaction, unless noted otherwise. Compaction shall be achieved with power operated tampers, rollers, idlers, or vibratory equipment, except as follows:
   1. Use pneumatic hand tampers for trenches and areas not accessible to heavy equipment.

B. Material type, maximum uncompacted layer depth, relative compaction, and general application are specified in Table A below. Relative compaction is defined as the ratio of the in-place soil dry density to the maximum dry density as determined by the ASTM D1557-78 test method.

TABLE A

| Max. Uncompacted Layer Depth (in.) | Min. relative compaction (%) | Application |
|---|---|---|
| 8 | 95 | Footing subgrade |
| 8 | 95 | Footing bearing pads |
| 8 | 90 | Footing and stemwall backfill |
| 8 | 90 | Slab-on-grade floor subgrade and subbase |
| 8 | 95 | Gravel walkway subgrade (upper 2 feet) |
| 8 | 90 | Utility trench backfill (more than 2’ below finish subgrade elevation) |
| 8 | 95 | Utility trench backfill (less than 2’ below finish subgrade elevation) |
| 8 | 90 | General site filling |

3.8 HAULING AND STOCKPILING

A. Hauling and traffic patterns:
   1. When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading and before departing the site. The loads shall be watered after trimming to minimize dust.
   2. Limit traffic patterns on-site to areas which have been armored or otherwise protected to preserve the stability of the exposed soil and prevent erosion and sediment suspension in runoff from said areas.

B. Stockpiling:
   1. Cover all stockpiles. Coordinate proposed stockpile locations with Owner. Submit stockpiling plan for approval by Owner indicating locations and dimensions of proposed stockpiles, and obtain Owner approval prior to construction of stockpiles.
   2. Construct stockpiles in accordance with WAC requirements. Side slopes shall be appropriate for the material to prevent sloughing, erosion, or instability.
   3. Provide plastic sheet for stockpile covering. Staked sandbags or other means shall be provided to secure stockpile covering to surface of stockpile and prevent exposure of stockpiled materials to the elements, contamination with moisture, and erosion of stockpile materials.

3.9 FIELD QUALITY CONTROL

A. Conduct in-place field density tests on the compacted material to check for adequate moisture content and the required relative compaction. Where less than the required relative compaction is achieved, remove and replace the soil, or moisture-condition the soil and apply additional compactive effort as necessary until the relative compaction as specified in 3.7 of this Section is attained.

3.10 REMOVAL OF MATERIALS

A. Remove materials from the site if they are either not approved for reuse, or they are in excess of that required. Legally dispose of the exported materials off site.

END OF SECTION

# SECTION 32 12 00

# ASPHALT PAVEMENT

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Furnish and place crushed surfacing.
   2. Furnish and place hot mix asphalt pavement.
   3. Patch pavement.

B. Work shall be in accordance with WSDOT Section 5-04, except as modified herein.

### 1.2 RELATED SECTIONS

A. Coordinate related requirements specified in other parts of the Specifications, including but not limited to following:
   Section 31 10 00 - Site Preparation
   Section 31 20 00 - Earthwork

### 1.3 REFERENCES

| | |
|---|---|
| WSDOT | 2022 Standard Specifications for Road, Bridge, and Municipal Construction. |
| ASTM D1557 | Methods of Test for Moisture-Density Relations of Soils, Using 10 lb (4.5 kg) Rammer and 18 In. (457 mm) Drop |
| ASTM D2922 | Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods. |
| APAW | Designs and Specifications for Asphalt Concrete Pavements and Bases, 1990 Edition |
| MUTCD | Manual on Uniform Traffic Control Devices, current edition |

### 1.4 SYSTEM DESCRIPTION

A. New HMA consists of multiple courses of plant mixed hot mix asphalt concrete placed on crushed surfacing in accordance with these Specifications and in conformity with the lines, grades, thicknesses, and typical cross-sections shown in the drawings or established by the Engineer.

### 1.5 SUBMITTALS

A. Submit Certificates: Furnish certification that all materials comply with Specification requirements; include laboratory test reports verifying compliance.
   1. Mixing plant to be member of Asphalt Paving Association of Washington (APAW) and approved by Engineer.
   2. Certified test results that meet City of Kirkland requirements.

1.6 PROJECT SITE CONDITIONS

A. Environmental Requirements:

1. In accordance with referenced standard specifications and the following:
   a. Do no paving in rain or when subgrade or base is wet or frozen.
   b. Do not apply tack coats when temperature is below 50 degrees F. or when base is wet.
   c. Apply asphalt concrete paving only when temperature is above 40 degrees and when base is dry.

1.7 WARRANTY

A. Work correction is to include aggregate separation, soft spots, and excess porosity.

B. Repair cracks; repair unsatisfactory elevation irregularities immediately upon notification; replace any paving not draining properly.

1.8 DIMENSIONS AND LAYOUT

A. All layout shall be provided by the Contractor. See Paragraph 31 10 00 - 1.7.

B. Preserve all benchmarks and stakes and replace any that are displaced or missing.

C. Review all records relating to the existing underground utilities. Avoid damage to these facilities and restore all utilities damaged as a result of the Contractor’s operations at its own expense.

D. Notify the Engineer immediately of underground utilities encountered, which are not shown on the plans.

PART 2 PRODUCTS

2.1 GENERAL

A. Comply with "Quality Control" provisions, "References", Specifications, and Manufacturer's data. Where these may be in conflict, the more stringent requirements govern.

1. Conform to APAW - Section II, "Specifications for Asphalt Paving" of above referenced manual.

2.2 CRUSHED SURFACING

A. Provide crushed surfacing top course meeting all requirements of WSDOT Section 9-03.9.

B. Provide crushed surfacing base course meeting all requirements of WSDOT Section 9-03.9.

2.3 TACK COAT

A. Provide diluted emulsion tack coat for paving joints, type SS-1, SS-1h, CSS-1 or CSS-1h, with equal parts of water.

2.4 HOT MIX ASPHALT CONCRETE

A. Aggregate shall be Class 1/2” conforming to Section 9-03.6 of WSDOT except no recycled materials shall be allowed. Asphalt binder shall be PG 64-22, and shall

comply with Section 9-02 of WSDOT. Asphalt concrete mixing and proportioning shall comply with Section 5-04 and 9-03.6 of WSDOT.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes your acceptance of conditions as satisfactory.

### 3.2 PREPARATION

A. Protect surrounding areas and surfaces to preclude damage from work of this Section.
   1. Protect work of other trades. Take special care in work adjacent to buildings.
   2. Should any defacement or damage occur, repair or replace as directed.
   3. Where new pavement is to abut existing concrete or asphalt pavement, the existing pavement shall be sawcut to provide a neat and straight edge at the joint.
   4. Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean all surfaces to be marked before application of the paint. Remove dust, dirt and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water or a combination of the methods as required. Completely remove rubber deposits, surface laitance, and other coating adhering to the pavement with scrapers, wire brushes, sandblasting, approved chemicals or mechanical abrasion as directed.

B. Preparation of Asphalt Patches:
   1. Where existing asphalt concrete pavement is required to be removed due to trenching, the area shall be uniformly defined in size and shape. The existing asphalt shall be removed by sawcutting pavement vertically at a sufficient distance of at least 12 inches outside the undisturbed base surface, and then the affected pavement shall be broken up and removed.

C. Preparation of existing surfaces:
   1. Existing paved surfaces to receive new ACP shall be prepared in accordance with WSDOT Section 5-04.3, and all cracks shall be sealed.

D. Prepare subgrade in accordance with Section 31 20 00

E. Traffic Control: Provide Traffic Control in accordance with AHJ requirements and the MUTCD.

### 3.3 CRUSHED SURFACING

A. Place crushed surfacing in accordance with Section 4-04 of WSDOT. Degree of compaction shall be a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D2922.

B. Prior to asphalt concrete placement, treat the prepared surface in accordance with WSDOT Section 5-04.3.

3.4 TACK COAT

A. Apply a tack coat to all existing pavement surfaces to be abutted with new asphalt pavement. Apply tack coat at a rate of 0.05 to 0.15 gal/sy. Do not place tack coat when the surface temperature of the pavement is below 50 degrees F or when rain is imminent.

3.5 HOT MIX ASPHALT CONCRETE

A. Place hot mix asphalt in accordance with WSDOT Section 5-04. Spreading, finishing and compaction shall be in accordance with WSDOT Section 5-04.3, except maximum lift depth shall be 2 inches.

B. Construct joints in accordance with WSDOT Section 5-04.3(10). Surface smoothness shall be in accordance with WSDOT Section 5-04.3(11). Accomplish paving in accordance with the weather limitations outlined in WSDOT Section 5-04.3(12).

C. Coordinate placement of the final lift of HMA in areas of overlay and full section paving to provide a uniform final surface with no joints at interface of overlay and full section pavement areas.

D. Sample and test asphalt concrete in accordance with WSDOT Section 5-04.3(7)B.

3.6 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphaltic materials. Do not permit vehicular traffic on asphaltic paving until it has cooled and hardened, and in no case sooner than six (6) hours after placing.

B. Provide barricades and warning devices as required and in accordance with MUTCD and AHJ requirements.

END OF SECTION

# SECTION 32 16 00

# CURBS AND SIDEWALKS

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Provide cement concrete curbs and cement concrete sidewalks.
   2. Provide crushed surfacing top course under sidewalks.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Specifications, including but not limited to following:
   Section 31 20 00 - Earthwork
   Section 32 14 00 - Cement Concrete Paving

### 1.3 REFERENCES

| | |
|---|---|
| WSDOT | 2022 Standard Specifications for Road, Bridge, and Municipal Construction. |

### 1.4 SUBMITTALS

A. Submit Certificates: Furnish certification in accordance with Section 00 71 00 that all materials comply with Specification requirements; include laboratory test reports verifying compliance.
   1. Certified test results (no more than 6 months old at the time of submittal) that meet WSDOT requirements.
B. Submit scoring and joint layout plan for new concrete sidewalks to Architect for review and approval. Drawing shall indicate direction for broom finish and type(s) of joints. Obtain approval prior to beginning construction of concrete curbs or sidewalks.

### 1.5 DIMENSIONS AND LAYOUT

A. All layout shall be provided by the Contractor. See Paragraph 31 10 00 - 1.7.
B. Preserve all benchmarks and stakes and replace any that are displaced or missing.
C. Review all records relating to the existing underground utilities. Avoid damage to these facilities and restore all utilities damaged as a result of the Contractor’s operations at its own expense.
D. Notify the Engineer immediately of underground utilities encountered, which are not shown on the plans.

## PART 2 - PRODUCTS

### 2.1 CEMENT CONCRETE

A. Provide air-entrained concrete Class 3000 conforming to the requirements of WSDOT Section 5-05. Provide Portland cement, aggregates, joint filler and curing materials conforming to Section 8-14.2 of WSDOT. Maximum aggregate size is to be 1 inch.

### 2.2 FIBRE JOINT MATERIAL

A. Fibre joint material shall be as manufactured by WR Meadows, or approved equivalent.

### 2.3 PRE-MOLDED JOINT FILLER

A. Provide pre-molded joint filler in accordance with WSDOT Section 9-04.1(2).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes your acceptance of conditions as satisfactory.
   1. Verify proper compaction of subgrade per Section 31 20 00.
   2. Verify existing dimensions and shapes. Conform to existing where applicable.

### 3.2 INSTALLATION

A. Install concrete curbs in accordance with plan drawings and WSDOT Section 8-04.3. Provide expansion joints at 10 foot spacing or less. Perform the work in a manner which results in a curb constructed to specified line and grade, uniform in appearance and structurally sound. Remove curbs found with unsightly bulges, ridges or other defects and replaced at Contractor's expense if Owner’s representative considers them irreparable. When checked with a 10-foot straightedge, grade shall not deviate more than 1/8 inch, and alignment shall not vary more than 1/4 inch. Curb repairs shall match existing grades.

B. Install cement concrete walkways in accordance with the plan drawings and WSDOT Section 8-14. Provide joints as indicated on Contractor’s approved joint diagram submittal. Install walkways flush with adjacent walks, door thresholds, etc. at connection points. Construct grade breaks in walks with smooth transitions, except at connections to specified landing areas. Achieve smooth transitions via vertical curves where feasible.

C. Spread the concrete for walks uniformly between the forms and compact thoroughly with a steel shod strikeboard. In construction of expansion (through) joints, adequately support the premolded joint filler until the concrete is placed on both sides of the joint.

D. Whenever castings are located in the sidewalk area, install joints at the casting location to control cracking of the sidewalk. If spacing of joints or scoring is such that installation of joint materials would be unsuitable, install rebar to strengthen the sidewalk section.

E. After the concrete has been thoroughly compacted and leveled, float with wood floats and finish at the proper time with a metal float.
F. Finish and score walks as indicated on approved scoring and joint layout plan. Refer to drawings for concrete walkway finish and jointing.

3.3 CLEANING

A. Leave premises clean and free of residue of work of this Section.

END OF SECTION

# SECTION 32 17 00

# PAVEMENT MARKINGS

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:

1. Furnish and install pavement markings on paved surfaces.
2. Provide, maintain, and remove temporary pavement markings and traffic controls and barricades.
3. Provide traffic control signage as indicated on the drawings.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:

Section 32 12 00 – Asphalt Pavement

### 1.3 REFERENCES

WSDOT-APWA 2022 Standard Specifications for Road, Bridge, and Municipal Construction. All references to measurement and payment therein shall be deleted from consideration.

MUTCD Manual on Uniform Traffic Control Devices, Current Edition.

Federal Specification TT-P-115, Traffic Paint

### 1.4 SAMPLING AND TESTING

A. Store materials proposed for use on the project site in sealed and labeled containers, or segregate at source of supply, sufficiently in advance of needs. Clearly identify materials by designated name, specification number, batch number, intended use and quantity formulation number, project contract number, intended use, and quantity involved. At the discretion of the Owner, material may be approved for use based on the following data furnished by the Contractor.

1. A test report showing that the proposed batch meets all specified requirements.

### 1.5 TEMPORARY TRAFFIC CONTROLS

A. Place suitable warning signs for alerting approaching traffic. Place traffic cones or markers along newly painted lines to control traffic and prevent damage to newly painted surfaces.

1.6 SUBMITTALS

A. Submit Certificates: Furnish certification in accordance with Section 00710 that all materials comply with Specification requirements; include laboratory test reports verifying compliance.

B. Submit dimensioned shop drawings of all signs.

PART 2 - PRODUCTS

2.1 TRAFFIC PAINT

A. Deliver and store paint in sealed containers that plainly show the designated name, formulation, or specification number, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be printed legibly at time of use. The paint shall be homogeneous, easily stirred to a smooth consistency, and shall show no hard settlement or other objectionable characteristics.

B. Paint for permanent pavement marking shall conform to Federal Specification TT-P-1952B, color: as required.

2.2 SIGNS

A. Signs shall be manufactured of sheet aluminum meeting requirements of WSDOT/APWA Section 9-28.8. All signs shall have rounded corners.

B. Sign messages and colors shall be in accordance with the MUTCD and the sign callouts on the drawings.

2.3 TEMPORARY PAVEMENT MARKINGS

A. Pavement markings for temporary delineations shall consist of reflective tape to establish required delineations, including, but not limited to, crosswalks, stop bars and turn arrows. Temporary pavement markers and temporary reflective tape shall be the same color as the lane line, centerline, or pavement marking the markers/tape replace.

2.4 WHEELSTOPS

A. Provide concrete wheelstops per the Construction Documents. Minimum length 6 ft and maximum height 5 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes your acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean all surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of the methods as required. Completely remove rubber deposits, surface laitance, and other coating adhering to the pavement with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed.

3.3 TEMPORARY DELINEATION

A. Whenever the work requires temporary reroutes of traffic, temporary or permanent pavement delineation shall be in place prior to opening the traveled way to public traffic. Lane line and centerline pavement delineation shall be provided at all times for traveled ways open to public traffic. In addition, crosswalks, stop bars, and pavement arrows shall be delineated prior to opening the area to traffic. The Contractor shall ensure that the appropriate striping and pavement markings are in place at all times to ensure safe traffic and pedestrian movement.

B. Install temporary striping and pavement markings to replace any existing striping and markings which have been removed, and to establish temporary routes of travel and parking stall markings.

C. Maintain temporary pavement delineation until replaced with permanent pavement delineation. Remove temporary pavement delineation as soon as the permanent pavement delineation is placed. When temporary pavement delineation is required to be removed, all lines and marks used to establish the alignment of the temporary pavement delineation shall be removed.

3.4 APPLICATION

A. **Two applications of paint are required to complete all on-site paint markings.** Apply paint evenly to the pavement surface to be coated at the rate of 105, plus or minus 5, square feet per gallon. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 50 degrees F and less than 95 degrees. Maintain paint temperature within these same limits. Apply paint pneumatically with approved equipment.

B. Provide guide lines and templates as necessary to control paint application. Take special precautions in marking letters and symbols. Sharply outline edges of markings. The drying time requirement in the paint specifications shall be strictly enforced to prevent pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the marking, until cause of the slow drying is determined and corrected.

3.5 SIGN INSTALLATION

A. Install signs at locations as shown on plans. Coordinate with adjacent improvements.

3.6 WHEELSTOPS

A. Install wheelstops per the Construction Documents and per manufacturer's recommendations.

3.7 CLEANING

A. Leave premises clean and free of residue of work of this Section.

END OF SECTION

# SECTION 33 10 00

# WATER DISTRIBUTION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Provide permanent connections to building water and fire system piping.
   2. Maintain project field plans and provide as-built plans per Owner and water district requirements.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Specifications, including but not limited to following:
   Section 31 20 00 - Earthwork

### 1.3 REFERENCES

WSDOT 2022 Standard Specifications for Road, Bridge, and Municipal Construction.

WWD Woodinville Water District

The Uniform Plumbing Code, current edition.

The International Association of Plumbing and Mechanical Officials (IAPMO) Standards.

American Water Works Association (AWWA) Standards.

### 1.4 PERMITS

A. Obtain permits required for work within the public right of way.

### 1.5 SUBMITTALS

A. Submittal format for water service materials downstream of meters shall be coordinated with format directions provided in Division 01.
B. Submit water service materials for review.

### 1.6 DIMENSIONS AND LAYOUT

A. Provide all layout. See Paragraph 311000 - 1.7.
B. Preserve all benchmarks and stakes and replace any that are displaced or missing.
C. Review all records relating to the existing underground utilities. Avoid damage to these facilities and restore all utilities damaged as a result of the Contractor’s operations at its own expense.
D. Notify the Engineer immediately of underground utilities encountered, which are not shown on the plans.

1.7 CONTRACTOR REQUIREMENTS

A. Contractor is responsible for coordinating all water system work with WWD, City of Kirkland, and the Owner. Provide minimum 2 weeks advanced notice to Owner of any planned water work affecting water system.

1.8 GENERAL STANDARDS

A. All work and materials shall be in conformance with WWD requirements, except as modified herein.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Domestic Water Service Pipe and Fittings
   1. High density polyethylene (PE) pipe, Driscopipe Ultra Line 5100 High Density Polyethylene meeting AWWA C901 requirements; PE 3408 material, SDR 7, Pressure Class 250 PSI, IPS or approved equivalent.
   2. Include 12-gauge tracer wire per WWD standards.

B. Fire Service Pipe and Fittings
   1. Between Meter and DCVA: Copper Tubing ASTM B88, Type K for buried piping per WWD standards.
      a. Tubing less than 2.5” in diameter shall be joined with brass compression fittings conforming to AWWA C800, minimum 150 PSI working pressure, with external gripping feature to prevent pull out. Fittings shall be Mueller Model 110 or approved equal.
   2. Downstream of DCVA: High density polyethylene (PE) pipe, Driscopipe Ultra Line 5100 High Density Polyethylene meeting AWWA C901 requirements; PE 3408 material, SDR 7, Pressure Class 250 PSI, IPS or approved equivalent.
   3. Include 12-gauge tracer wire per WWD standards.

2.2 OTHER MATERIALS

A. Provide plastic Foam for pipe protection and separation between pipes meeting the Federal spec. PPP-C-1752B Type 1, Class 2.
B. Bury detection tape with all non-metallic pipe, in accordance with WSDOT/APWA Section 9-15.18.

2.3 BEDDING AND BACKFILL MATERIAL

A. Provide bedding material per Section 31 20 00.
B. Provide backfill material per Section 31 20 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to beginning any water line construction or ordering materials, excavate and expose existing water system at proposed point of connection and verify required materials for connection and depth of connection points. Notify Engineer of any discrepancies.

B. Beginning of installation means acceptance of existing conditions.

3.2 TRENCHING

A. Excavate and prepare the trench in accordance with Section 31 20 00.
B. Keep the trench free from water. Divert surface water so it does not enter trench.
C. Remove boulders, rocks, and other obstructions to the width of the trench and to a depth of 6 inches below the elevation of bottom of pipe.
D. Trench utilizing hand tools as necessary in areas of conflict with other existing utility lines or roots of trees to remain.

3.3 WATER AND FIRE SERVICE INSTALLATION AND ADJUSTMENT

A. Install pipe in accordance with WWD requirements, utilizing bedding and backfill material as specified herein.
B. Provide design of any deadman and temporary blocking required for connections to existing systems.
C. Provide survey line and grade control hubs placed by a survey crew working under the direction of a licensed land surveyor.
D. Record elevation and location of installed pipe and appurtenances at the time of installation and prior to backfill in accordance with WWD as built requirements.
E. Install 12-gauge tracer wire on non-metallic water lines per WWD standards.

3.4 BEDDING AND BACKFILLING

A. Install bedding in accordance with Section 31 20 00 and the details in the plans.
B. Backfill trenches in accordance with Section 31 20 00 and the details in the plans.

3.5 TESTING, CLEANING AND FLUSHING

A. Pressure test and disinfect all pipe prior to connection to existing water system. Clean, test, and flush pipe in conformance with WWD requirements.
B. Provide for proper collection, discharge, and disposal of flushing water in accordance with requirements of affected AHJs.

3.6 AS BUILT PLANS

A. Record as built locations of new facilities. Maintain field plans which accurately and legibly record all as built information and revisions.

END OF SECTION

# SECTION 33 30 00

# SANITARY SEWER

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to following:
   1. Furnish and install sanitary sewer lines, fittings, cleanouts, and castings, in accordance with the plans and Specifications.
   2. Connect to existing sanitary sewer piping.
   3. Connect to building waste piping.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Specifications, including but not limited to following:
   Section 31 20 00 - Earthwork

### 1.3 REFERENCES

WSDOT 2022 Standard Specifications for Road, Bridge, and Municipal Construction.

The Uniform Plumbing Code, current edition.

The International Association of Plumbing and Mechanical Officials (IAPMO) Standards.

### 1.4 DIMENSIONS AND LAYOUTS

A. Provide all layout. See Paragraph 311000 - 1.7.
B. Preserve all benchmarks and stakes and replace any that are displaced or missing.
C. Review all records relating to the existing underground utilities. Avoid damage to these facilities and restore all utilities damaged as a result of the Contractor’s operations at its own expense.
D. Notify the Engineer immediately of underground utilities encountered, which are not shown on the plans.

### 1.5 SUBMITTALS

A. Submit manufacturer's data on sanitary sewer materials and equipment.

### 1.6 CONTRACTOR REQUIREMENTS

A. Coordinate all sanitary sewer work with Northshore Utility District and KCHA.

### 1.7 GENERAL STANDARDS

A. Complete all work and provide materials in conformance with NUD requirements, except as modified herein.

## PART 2 PRODUCTS

### 2.1 PIPE

A. Provide PVC pipe conforming to Section 9-05.12 of WSDOT, and ASTM 3034, SDR 35 with rubber gasket joints.

### 2.2 BEDDING AND BACKFILL MATERIAL

A. Provide bedding material per Section 312000.
B. Provide backfill material per Section 312000.

### 2.3 IDENTIFICATION

A. Provide detectable underground pipe tracer tape, color coded, with utility name printed on tape. Install conductive warning tape over all water, sewer, drainage, and irrigation pipe at 18” below finished grades. Underground - Type Plastic Line Markers: Permanent, bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service; not less than 3" wide x 5 mils thick. Detectable Marking Tape color shall be as follows:

Tape Schedule:

| Piping | Color | Wording |
|---|---|---|
| Sanitary Sewer | Green | Caution Sanitary Sewer |

## PART 3 EXECUTION

### 3.1 TEMPORARY BYPASSING

A. Keep existing sanitary sewer systems operational during construction. Provide bypass systems as required based on contractors’ operations and sequencing of installation of new improvements in order to ensure existing sewer system maintains its functionality with no blockages, surcharges, flooding, or any other detrimental impacts.
B. Coordinate all temporary bypasses with KCHA and the Northshore Utility District prior to implementation, and meet all NUD requirements.
C. Size bypass systems to accommodate all potential flows and prevent any detrimental effects to existing facilities and improvements, including but not limited to surcharging of existing systems, surface ponding, flooding, or erosion.
D. Provide monitoring as required to ensure functioning of system as required by operations.
E. Provide all pumps, piping, plugs, power supplies, and any other appurtenances, materials, equipment and labor required for installation, maintenance, monitoring, and removal of bypass systems.

### 3.2 TRENCHING

A. Excavate and prepare the trench in accordance with Section 312000.
B. Keep trenches free from water. Divert surface water such that is it does not enter trench.
C. Remove boulders, rocks, and other obstructions, or cut out to the width of the trench and to a depth of 6 inches below the elevation of bottom of pipe.

3.3 PIPE INSTALLATION

A. Install pipe in accordance with Section 7-08.3(2) of WSDOT, except that survey line and grade control hubs shall be provided by a survey crew working under the direction of a licensed land surveyor or licensed Engineer provided by the Contractor.

B. Include necessary fittings to make vertical and horizontal transitions at connections to building plumbing. Install cleanouts per plans.

3.4 BEDDING AND BACKFILLING

A. Install bedding in accordance with NUD and Section 312000.

B. Backfill trenches in accordance with NUD and Section 312000.

C. Install detectable warning tape with a metallic foil core for non-metallic pipe for full length of each pipe run. Install tape eighteen inches below finished grade.

3.5 MANHOLE ADJUSTMENT

A. Adjust sanitary sewer structures in accordance with Section 7-05.3 of WSDOT-APWA

B. Adjust to final finished grade, all existing sanitary sewer structures to remain. Provide additional structure sections as required to achieve a total access riser height of no more than 18”.

C. Relocate existing handholds and ladder and provide additional handholds and ladder sections as required.

3.6 CLEANING AND TESTING

A. Clean and test all new pipes in conformance with Section 7-04.3(1) of WSDOT after installation. Utilize air pressure tests unless otherwise required by AHJ. Conduct tests in the presence of the Engineer.

B. Clean all new piping and structures prior to final acceptance. Clean full length of existing storm pipelines and structures to be retained for use.

C. Utilize high-velocity hydro-cleaning equipment, hydraulically propelled equipment, and/or mechanically powered equipment capable of removing dirt, grease, rocks, sand, roots, and obstructions.

D. Clean system proceeding from upstream end of system toward downstream end of system. Cleaning shall restore existing pipelines to their original carrying capacity. Provide CCTV inspection of pipelines documenting results of cleaning operations.

E. Remove material resulting from cleaning operations from the system and dispose of it off-site in accordance with all applicable local, State and Federal requirements. Plug lowest outlet and remove all flushing water and debris prior to discharge, and dispose off-site.

3.7 AS-BUILT PLANS

A. Record surveyed as built locations and invert elevations of new facilities, and maintain field plans which accurately and legibly record all as built information and revisions.

B. Provide as built plans and documents to KCHA per their requirements and the requirements of NUD.

END OF SECTION

# SECTION 33 40 00

# STORM DRAINAGE

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work includes but is not limited to the following:
   1. Furnish and install stormwater collection and conveyance systems, structures, and storm drain piping of the type and sizes designated in the plans and specifications.
   2. Provide connections to existing facilities.
   3. Provide storm drainage bypass piping and bypass pumping systems if required.

### 1.2 RELATED SECTIONS

A. Coordinate related work specified in other parts of the Specifications, including but not limited to following:
   Section 31 20 00 - Earthwork

### 1.3 REFERENCES

| | |
|---|---|
| KCSWDM | 2016 King County Surface Water Design Manual |
| WSDOT | 2022 Standard Specifications for Road, Bridge, and Municipal Construction. |

### 1.4 DIMENSIONS AND LAYOUT

A. All layout shall be provided by the Contractor. See Paragraph 31 10 00 - 1.7.
B. Preserve all benchmarks and stakes and replace any that are displaced or missing.
C. Review all records relating to the existing underground utilities. Avoid damage to these facilities and restore all utilities damaged as a result of the Contractor’s operations at its own expense.
D. Notify the Owner immediately of underground utilities encountered, which are not shown on the plans.

### 1.5 SUBMITTALS

A. Submit manufacturer's data on storm drain materials and equipment.

### 1.6 TEMPORARY BYPASSING

A. Keep existing storm drainage systems operational during construction, unless indicated otherwise. Provide bypass systems as required by contractors’ operations and sequence installation of new improvements in order to ensure existing storm drainage system maintains its functionality with no ponding, erosion, flooding, or any other detrimental impacts.
B. Coordinate all temporary bypasses with the Owner and all affected AHJs prior to implementation.

C. Provide all pumps, piping, plugs, power supplies, and any other appurtenances, materials, equipment, and labor required for installation, maintenance, monitoring, and removal of bypass systems.

## PART 2 - PRODUCTS

### 2.1 STORM DRAINS

A. Provide PVC pipe material for on-site storm drains unless indicated otherwise.

### 2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. Provide PVC pipe conforming to Section 9-05.12 of WSDOT, ASTM 3034, SDR 35 with rubber gasket joints.
B. Provide fittings of the same material as the pipe.

### 2.3 BEDDING AND BACKFILL MATERIAL

A. Provide bedding material per Section 31 20 00.
B. Provide backfill material per Section 31 20 00.

### 2.4 COUPLINGS AND JOINTS

A. Provide joints and couplings with a watertight connection testable with the storm drain lines upon which they are installed.
B. Provide tees on existing pipe connected by core drilling and flexible connections.
C. Make pipe to pipe connections between pipes of differing materials with a flexible gasketed coupling, adapter, or coupling-adapter to make a watertight joint. Provide couplings manufactured by Romac or approved equivalent.
D. Utilize GPK manhole adapter or approved equivalent for connections to drainage structures.

### 2.5 CATCH BASINS AND GRATES

A. Provide catch basins as indicated on the drawings.
B. Provide bolt-locking grates for catch basins as indicated on the drawings. All grates must be embossed with the messages “OUTFALL TO STREAM” and “DUMP NO POLLUTANTS,” or approved equivalent.
C. Provide Olympic Foundry SM60 diagonal grate or approved equivalent.
D. Provide Olympic Foundry SM60S solid cover or approved equivalent.

### 2.6 AREA DRAINS

A. Provide 12-inch Nyloplast area drains as indicated on the drawings.

2.7 IDENTIFICATION

A. Provide utility pipe tracer tape detectable below ground surface, color coded, with utility name printed on tape. Conductive warning tape required over all non-metallic water, sewer, drainage, and irrigation pipe at 18” below finished grades. Underground - Type Plastic Line Markers: Permanent, bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service; not less than 3" wide x 5 mils thick. Detectable Marking Tape color shall be as follows:

Tape Schedule:

| Piping | Color | Wording |
|---|---|---|
| Storm Drain | Green | Caution Storm Drainage |

PART 3 - EXECUTION

3.1 TRENCHING

A. Excavate and prepare the trench in accordance with WSDOT and Section 31 20 00.
B. Keep the trench free from water. Divert surface water so it does not enter trench.
C. Remove boulders, rocks, and other obstructions or cut them out to the width of the trench and to a depth of 6 inches below the elevation of bottom of pipe.

3.2 PIPE INSTALLATION

A. Install pipe in accordance with Section 7-18.3 of WSDOT, except that the Contractor is responsible for providing survey line and grade control hubs by a survey crew working under the direction of a licensed land surveyor or licensed Engineer provided by the Contractor.

3.3 BEDDING AND BACKFILLING

A. Install bedding in accordance with Section 31 20 00, and the details in the drawings.
B. Install backfill in trenches in accordance with Section 31 20 00, and the details in the drawings.
C. Install detectable warning tape for non-metallic pipe for full length of each pipe run. Install detectable tape 18” below finished grade.

3.4 STRUCTURE INSTALLATION AND ADJUSTMENT

A. Install and adjust storm drain structures in accordance with Section 7-05.3 of WSDOT, except backfill per Section 31 20 00.
B. Adjust to final finished grade all existing storm drain structures to remain. Provide additional structure riser sections as required to achieve a total access riser height of no more than 18 inches. Relocate existing handholds and ladder and provide additional handholds and ladder sections as required.
C. Verify orientation with proposed improvements including curbs and pavement edges.
D. Grout all adjustment sections and penetrations with non-shrink grout.

3.5 TEMPORARY BYPASSING

A. Coordinate all bypassing with Owner and utility provider. Obtain all required approvals prior to implementation.
B. Size bypass systems to accommodate all potential flows and prevent any detrimental effects to existing facilities and improvements, including but not limited to surcharging of existing systems, surface ponding, flooding, or erosion
C. Provide monitoring as required to ensure functioning of system as required by operations.

3.6 PERMANENT CONNECTIONS TO EXISTING SYSTEMS

A. Where indicated on the plans, make permanent connections to existing storm drain systems.
B. Where new pipe is to be connected to an existing structure, make connection by core drilling and installation of a sand collar. Rebuild structure as necessary to provide an approved connection per the drawings. Relocate ladders and other appurtenances as required to allow for new connection and provide minimum 1’ clearance from edge of pipe to edge of appurtenance.

3.7 CLEANING AND TESTING

A. Clean and test in conformance with Section 7-18.3 of WSDOT. Subject all new lines to testing after installation. Tests shall be air pressure test unless otherwise required by the City of Kirkland inspector. Conduct tests in the presence of the Owner.
B. Clean all new piping and structures prior to final acceptance. Clean full length of existing storm pipelines and structures to be retained for use.
C. Utilize high-velocity hydro-cleaning equipment, hydraulically propelled equipment, and/or mechanically powered equipment capable of removing dirt, grease, rocks, sand, roots, and obstructions.
D. Proceed with cleaning from upstream end of system toward downstream end of system. Cleaning shall restore existing pipelines to their original carrying capacity. Provide CCTV inspection of pipelines documenting results of cleaning operations.
E. Remove material resulting from cleaning operations from the system and dispose it off-site in accordance with all applicable local, State, and Federal requirements. Plug lowest outlet and remove all flushing water and debris prior to discharge, and dispose off-site.

3.8 AS-BUILT PLANS

A. Record as-built locations and elevations of new facilities. Survey all pipes for line and invert prior to backfill. Maintain field plans which accurately and legibly record all as-built information and revisions, including but not limited to locations of all piping and structures/drains, rim elevations, invert elevations, surface finish grading, and toe and top of slopes.

END OF SECTION