

Executed Counterparts Counterpart No. \_\_\_\_\_ of \_\_\_\_\_

Including Addenda Nos. \_\_\_\_\_ through \_\_\_\_\_

CPA No. \_\_\_\_\_

# **Georgetown Wet Weather Treatment Station - Treatment Station**

**Contract No. C01025C17**

**Funded in part by the  
Washington State Department of Ecology**

**Volume 3 of 23**

**Technical Specifications**  
(Division 3 – Division 10)

**May 2017**



**King County**

**Department of Natural Resources and Parks  
Wastewater Treatment Division**



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# DIVISION 03

## CONCRETE

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## SECTION 03100

### CONCRETE FORMS AND ACCESSORIES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies formwork for cast-in-place concrete, with shoring, bracing and anchorage, openings for other work, form accessories, and form stripping.

##### 1.02 QUALITY CONTROL

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ACI 117	Specification for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	Structural Concrete for Buildings
ACI 303.1	Standard Specification for Cast-In-Place Architectural Concrete
ACI 303R	Guide to Cast-in-Place Architectural Concrete Practice
ACI 318	Building Code Requirements for Reinforced Concrete and Commentary
ACI 347	Guide to Formwork for Concrete
NIST PSI	Structural Plywood
SBC	Seattle Building Code

- B. Perform work of this Section in accordance with ACI 347, ACI 301, and ACI 318.
1. Maintain one copy of standards on project site.
- C. Design formwork under direct supervision of a Professional Engineer experienced in design of concrete formwork and licensed in the state of Washington.
- D. When high-range water reducer (superplasticizer) is used in concrete mix, form design shall account for increased hydrostatic pressures.
- E. Joints in forms shall be watertight.
- F. Limit panel deflection to 1/360th of each component span to achieve specified tolerances.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Provide data on concrete formwork, form release agent, formwork accessories, void form materials and installation requirements.
- C. Shop drawings: prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington, indicating pertinent dimensions, materials, bracing, and arrangement of joints and ties. Indicate temporary shoring components and permanent shoring components that will remain as part of the structure.

- D. Statement of qualifications for formwork designer.

#### **1.04 DESIGN REQUIREMENTS**

- A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

#### **1.05 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for design, fabrication, erection and removal of formwork.

#### **1.06 MOCK-UP**

- A. Construct a mock-up of formwork to be used for all concrete surfaces exposed to view on the Facility Building and all retaining wall surfaces exposed to view, 8 feet long by 8 feet wide for each mock-up.
  - 1. Include reinforcement, ties, and accessories specified in Section 03200.
  - 2. Provide concrete in accordance with provisions of Section 03300.
  - 3. Cure concrete in accordance with provisions of Section 03300.
- B. Locate mock-up where directed.
- C. Mock-up may or may not remain as part of the Work as directed by the Project Representative.

#### **1.07 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver void forms per installation instructions in manufacturer's packaging.
- B. Store void forms off ground in ventilated and protected manner to prevent deterioration from moisture.

### **PART 2 PRODUCTS**

#### **2.01 FORM MATERIALS**

- A. Forms for walls and underside of slabs and beams (CONC-1): shall be hard plastic finished plywood, overlaid waterproof particle board, or steel in "new and undamaged" condition, of sufficient strength and surface smoothness to produce specified finish.
  - 1. Provide special edges or sealant to provide grout-tight joints between form panels.
  - 2. Circular structure: Wall forms shall conform to circular shape of structure.
- B. Forms for walls with CONC-2 designation, use Reckli 2/30 B Havel formliner or Approved Equal as determined by Project Representative.
- C. Forms for columns:
  - 1. Rectangular columns: As specified for walls.
  - 2. Circular columns: Fabricated steel or fiber-reinforced plastic with bolted sections or spirally wound laminated fiber form. Internally treat with release agent for full height of column.
- D. All other forms: As specified for walls.
- E. Wood forms shall be of recycled, reused, or Forest Stewardship Council Certified wood.



## 2.02 FORMWORK ACCESSORIES

- A. Form Ties:
  - 1. Material: Steel.
  - 2. Spreader Inserts:
    - a. Conical or spherical type.
    - b. Design to maintain positive contact with forming material.
    - c. Furnish units that will leave no metal closer than 1.5 inch to concrete surface when forms, inserts, and tie ends are removed.
  - 3. Wire ties not permitted.
  - 4. Flat bar ties for panel forms, furnish plastic or rubber inserts with minimum 1-inch depth and sufficient dimensions to permit patching of tie hole.
  - 5. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
    - a. Integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie.
    - b. Neoprene water stop 3/16 inch thick and 15/16-inch diameter whose center hole is 1/2-diameter of tie, or molded plastic water stop of comparable size.
    - c. Orient water stop perpendicular to tie and symmetrical about center of tie.
    - d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
  - 6. Form Tie Plugs: Hard rubber or plastic; configuration to fit form tie holes with exterior face of plug 1/2 to 3/4 inch below surface of concrete.
    - a. Color: Medium to dark gray.
    - b. Adhesive: Permanent, weatherproof adhesive; type recommended by plug manufacturer.
  - 7. Through-Bolts: Tapered minimum 1-inch diameter at smallest end.
  - 8. Elastic Vinyl Plug:
    - a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length, and diameter upon removal forming watertight seal.
    - b. Manufacturer and Product: Dayton/Richmond Co., Miamisburg, OH; A58 Sure Plug, or Approved Equal.
  - 9. Provide "SuperTie" by RJD Industries, or Approved Equal; pultruded fiberglass ties at locations with CONC-2 and CONC-3 designation.
- B. Form Release Agent:
  - 1. Material:
    - a. Ready-to-use water-based material formulated to reduce or eliminate surface imperfections.
    - b. Contain no mineral oil or organic solvents.
    - c. Environmentally safe.
    - d. Shall not bond with, stain or adversely affect concrete surfaces or subsequent surface treatments.
  - 2. Acceptable manufacturers:
    - a. BASF: MBT MasterFinish RL 211.
    - b. Cresset Chemical Company: Crete-Lease 20-VOC-Xtra.
    - c. Approved Equal.
- C. Nails, Spikes, Lag Bolts, She-Bolts, Through Bolts, and Anchorages:
  - 1. Sized as required.
  - 2. Of sufficient strength and character to maintain formwork in place while placing concrete.
  - 3. Provide plastic cones and plugs similar to Form Ties and Form Tie Plugs.
  - 4. She-bolts shall have tapered noses.
- D. Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Verify lines, levels and centers before proceeding with formwork.
- B. Ensure that dimensions agree with Drawings.
- C. Prior to coating surface, thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants.
- D. Steel forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.

### **3.02 EARTH FORMS**

- A. Earth forms are not permitted.

### **3.03 ERECTION - FORMWORK**

- A. Erect formwork, shoring and bracing to achieve design requirements:
  - 1. Reference standards:
    - a. ACI 301.
    - b. ACI 318.
    - c. ACI 347.
  - 2. Exposed to view concrete (Architectural Concrete) shall also meet:
    - a. ACI 303.
    - b. ACI 303R.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of shoring and placement of reshoring in accordance with the most stringent requirements of the Referenced Standards.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated in the Drawings.
- F. Chamfer strips:
  - 1. Provide 3/4 inch fillet strips at concrete edges, except as noted herein.
  - 2. Do not provide chamfer on exterior corners of:
    - a. Area 200 Electrical Building.
    - b. Area 300 Screenings Building.
    - c. Area 800 Electrical Building.
    - d. Area 900 Generator Building.
    - e. Area 900 Operations and Maintenance Building.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Coordinate this Section with other Sections of work that require attachment of components to formwork.

- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Project Representative before proceeding.

### **3.04 APPLICATION - FORM RELEASE AGENT**

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
  - 1. Exposed wood forms in contact with concrete: apply form release agent as recommended by manufacturer.
  - 2. Steel forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are adversely affected by the form release agent.
  - 1. Soak inside surfaces of untreated forms with clean water.
    - a. Keep surfaces coated prior to placement of concrete.

### **3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other Sections in forming and placing openings, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install waterstops in accordance with Section 03251
- 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.

### **3.06 FORM CLEANING**

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

### **3.07 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 117 and ACI 301.

- B. Camber slabs and beams  $\frac{1}{4}$  inch per 10 feet (2mm/m).
- C. In addition to the requirements of ACI 117 and ACI 301, construct formwork for exposed to view concrete (Architectural Concrete) to maintain the tolerances required by ACI 303.1 where they are more stringent. Camber slabs and beams in accordance with ACI 301.

### **3.08 FORM REMOVAL**

- A. Nonsupporting forms, sides of beams, walls, columns, and similar parts of Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
  - 1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
  - 2. Curing and protection operations are maintained.
- B. Elevated Structural Slabs or Beams: In accordance with ACI 318, Chapter 6, and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.
- C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms..

### **3.09 FIELD QUALITY ASSURANCE AND QUALITY CONTROL**

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- B. Owner-Furnished Quality Assurance, in accordance with SBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan as indicated in the Drawings. Contractor responsibilities and related information are included in Section 01420, Special Inspection, Observation, and Testing.
- C. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01410, Construction Testing.

**END OF SECTION**

## SECTION 03200

### CONCRETE REINFORCEMENT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies reinforcing steel for use in reinforced concrete.

##### 1.02 QUALITY CONTROL

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ACI 318	Building Code Requirements for Structural Concrete
ASTM A497	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRSI-PRB	Placing Reinforcing Bars
CRSI-MSP	Manual of Standard Practice
ICC	International Code Council

- B. Welder Qualifications: Certified in accordance with AWS D1.4/D1.4M.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Shop drawings and Product Data:
1. Technical data of reinforcing bars, dowel bars, tie bars, bar supports.
  2. Reinforcing bar shop and placement drawings.
  3. Bar lists and bending details.
  4. Bar tags.
  5. Mechanical Threaded Connections: Current International Code Council (ICC) Evaluation Report and Manufacturer's Instructions.
  6. Lab test reports for reinforcing steel showing stress-strain curves and ultimate strengths.
  7. Welding Qualification: Prior to welding, submit welder qualifications and nondestructive testing procedures in accordance with Section 05050.
  8. Test results of field testing.

##### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Unload, store, and handle bars in accordance with CRSI publication "Placing Reinforcing Bars."

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Bar Reinforcement: Deformed billet steel conforming to ASTM A615, Grade 60, including supplementary requirements except No. 2 bars.
- B. Bar Reinforcement to be welded: Deformed billet steel conforming to ASTM A706, Grade 60. Welding reinforcing shall not be permitted unless indicated in the Drawing or permitted in writing by the Project Representative.
- C. Tie Bars: Deformed billet steel bars conforming to the requirements of ASTM A615, Grade 60.
- D. Spiral Ties: Spiral ties shall conform to the requirements of ASTM A1064.
- E. Mechanical Splices:
  - 1. Mechanical splices shall meet the requirements of a Type 2 mechanical splice of ACI 318.
- F. Bar Supports, Tie Wire and Trim Steel:
  - 1. Use precast concrete bar supports or all-plastic bar supports and side form spacers, unless noted otherwise. Do not use other types of supports or spacers.
  - 2. Locate in accordance with CRSI Manual of Standard Practice.
  - 3. Show reinforcing steel required on the shop drawings.
  - 4. Tie wire shall be black, soft-annealed 16 gage wire.
  - 5. Precast concrete bar supports:
    - a. Use where concrete surfaces are exposed to weather, earth, water, chloride intrusion, or corrosive chemicals.
    - b. Shall be nonconductive and have geometry and bond characteristics that deter movement of moisture from the surface to the reinforcement.
    - c. Shall have the same minimum strength and shall be made from same materials as that of the concrete in which they are to be embedded.
    - d. Shall be cast and properly cured for at least 7 days before use and shall have a wire or other device cast into each block for the purpose of attaching them securely to reinforcing steel.
    - e. Total bond precast high performance concrete bar supports as supplied by Con Sys Inc., Pinawa, MB, Canada, or Approved Equal.
    - f. Use in Beams, Columns, Walls, and Slabs Exposed to View after Form Removal:
    - g. Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports do not possess necessary geometry, strength, or stiffness.
  - 6. Plastic Bar Supports:
    - a. Manufactured by Aztec Concrete Accessories, Bloomington, CA., or Approved Equal.
  - 7. Bury bars are not permitted for support of reinforcement.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Fabrication:
  - 1. Reinforcing steel:
    - a. Do not bend or straighten in a manner that will damage the material.
    - b. Do not use bars with kinks or with bends not indicated in the Drawings.
    - c. Fabricate in accordance with CRSI MSP-1.
  - 2. Heating or welding bars shall only be permitted where indicated in the Drawing or permitted in writing by the Project Representative. Unless otherwise indicated:
    - a. Perform in accordance with AWS D1.4.
    - b. Welders shall meet the requirements of AWS D1.4.

- c. Do not weld bars at the bend.
  - d. Tack welding of cross bars is not acceptable.
  - e. Only ASTM A706/A706M bars may be welded.
- B. Placement:
- 1. Place reinforcing steel in accordance with CRSI- PRB, the Drawings, and the applicable shop drawing per the reinforcing steel supplier.
  - 2. Include reinforcing steel as required by CRSI-MSP or CRSI-PRB when not specifically indicated in the Drawings or explicitly referred to in the Specifications.
  - 3. Unless otherwise indicated, provide concrete cover as indicated in the Drawings.
  - 4. Position reinforcing steel accurately and secure against displacement at intersections with tie wire and support by concrete or metal chairs, spacers or metal hangers.
  - 5. Unless otherwise indicated, do not place reinforcing steel on fresh concrete or force the steel into fresh concrete.
  - 6. When moisture-proofing is used, support reinforcing steel or mesh with supports designed with flat bases to protect the membrane at all times.
  - 7. Notify Project Representative when reinforcing steel is ready for inspection and allow sufficient time for inspection prior to placing concrete.
- C. Splicing:
- 1. Lap splice reinforcing steel a Class B Lap Splice as provided by ACI 318 unless otherwise indicated in the Drawings.
  - 2. In slabs, beams, girders, and walls subject to lateral pressure, do not splice reinforcing steel in areas of maximum stress.
  - 3. Unless otherwise indicated, stagger splices of adjacent bars as indicated in the Typical Details of the Drawings or as required by ACI 318.
- D. Mechanical Splices, including splices, couplers and form savers:
- 1. Mechanical Splices (ACI 318 Type 2) may be substituted for Lap.
  - 2. Mechanical Splices (ACI 318 Type 2) shall be substituted for Lap Splices at any location where a Class B Lap Splice cannot be placed due to congestion or conflicts of any kind.
  - 3. Mechanical Splices shall be installed in accordance with the manufacturer's recommendations.
- E. Tying reinforcing bars:
- 1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
  - 2. Bend tie wire away from concrete surface to provide clearance of 1 inch from surface of concrete to tie wire.
- F. Additional reinforcement around openings:
- 1. Additional reinforcement shall be placed around openings in concrete construction as indicated in the Drawings.
  - 2. If no reinforcing is indicated in a slab or wall, the Typical Opening Reinforcing indicated in the Structural Standard Details shall be required.
  - 3. In the event that the Typical Details do not apply, additional reinforcing equivalent to the cross sectional area of the steel cut by the opening shall be added, equally distributed on all sides. The additional steel shall be extended beyond the limits of the opening a minimum of one development length (straight or hooked).
- G. Cleaning:
- 1. Clean steel of mill rust scale, dried concrete, or other coatings that may reduce bond.
  - 2. Reinforcement reduced in section is not acceptable.
  - 3. Remove debris in the placement area prior to concrete placement.
  - 4. When concrete placement is delayed, special cleaning of reinforcement may be required by the Project Representative.

### **3.02 FIELD QUALITY CONTROL**

- A. Demonstrate conformance with the specified requirements for concrete reinforcement and welded rebar by an independent testing laboratory that complies with the requirements of ASTM E329.
- B. The County may elect to also test concrete reinforcement Section 01410.
- C. Special inspection will be provided by Owner in accordance with Section 01420, as indicated on Drawings.

**END OF SECTION**



**SECTION 03251**  
**CONCRETE JOINTS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies the requirements for joints in cast-in-place concrete.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A36/A36M	Specification for Carbon Structural Steel
ASTM A615/A615M	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A767/767M	Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM C920	Specification for Elastomeric Joint Sealants
ASTM D226	Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D227	Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D994	Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1056	Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
ASTM D1751	Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
COE CRD-C-572	Corps of Engineers Specifications for Polyvinylchloride Waterstop

- B. Qualifications: Water stop manufacturer shall demonstrate 5 years', minimum, continuous successful experience in production of PVC water stops.

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Shop drawings:
1. Water Stops: Details of splices, method of securing and supporting water stop in forms to maintain proper orientation and location during concrete placement.
  2. Construction and Control Joints: Layout and location for each type, including location of waterstop. Include joints indicated in the Drawings, additional required joint locations, and any proposed locations.
- C. Samples: PVC water stop splice for each size, shape, and fitting of water stop(s).

- D. Manufacturer's written instructions for product shipment, storage, handling, installation/application, and repair for:
  - 1. Water stop.
  - 2. Bond breaker.
  - 3. Joint filler and primer.
  - 4. Preformed control joint.
  - 5. Certification:
    - a. Letter stating compatibility between liquids being contained and materials used for:
      - 1) Waterstops.
      - 2) Joint fillers.
    - b. Manufacturer's application instructions for:
      - 1) Bonding agent.
      - 2) Bond breaker.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Acceptance at Site: Verify that delivered materials are in accordance with Specifications and manufacturer's product data sheets prior to unloading and storing onsite.
- B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight.

#### **1.05 WARRANTY**

- A. For the Work of this Section, provide all warranties as described in the General Conditions 00700, Subsection 7.9B, and provide all normal commercial warranties available, as described in the General Conditions.

### **PART 2 PRODUCTS**

#### **2.01 PLASTIC WATER STOP**

- A. Extruded from elastomeric plastic compound of which basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.
- B. Specific Gravity: Approximately 1.37.
- C. Shore Durometer Type A Hardness: Approximately 80.
- D. Performance Requirements: Corps of Engineers' Specification CRD-C-572.
- E. Type: Center bulb with parallel ribs or protrusions on each side of strip center.
- F. Corrugated or tapered type water stops are not acceptable.
- G. Thickness: Constant from bulb edge to outside stop edge.
- H. Minimum Weight per Foot of Water Stop:
  - 1. 1.60 pounds for 3/8 inch by 6 inches.
- I. Factory Fabrications: Use only factory-made water stop fabrications for all intersections, transitions, and changes of direction.

- J. Manufacturers and Products:
  - 1. Vynlex Corp.; Catalog No. 03250/VIN: No. RB6-38H (6 inches by 3/8 inch).
  - 2. Greenstreak Plastic Products, Catalog No. 03150/GRD: Style 732 (6 inches by 3/8 inch).
  - 3. Four Seasons Industries Durajoint, Catalog No. CSP-162: Type 9 (6 inches by 3/8 inch).
  - 4. Approved Equal.

## **2.02 HYDROPHILIC WATER STOP**

- A. For use at construction joints only, where new concrete is placed against existing concrete and as indicated in the Drawings.
- B. Material shall be a nonbentonite hydrophilic rubber compound.
- C. Manufacturers and Products:
  - 1. Greenstreak Plastic Products, Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
  - 2. Adeka Ultra Seal, OCM, Inc., MC-2010M with 3M-2141 adhesive and P-201 sealant.
  - 3. Approved Equal.

## **2.03 BOND BREAKER**

- A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as joint, that will adhere to premolded joint material or concrete surface.
- B. Use either bond breaker tape or bond prevention material as specified in Section 03300, except where tape is specifically called for.

## **2.04 POURABLE JOINT FILLERS**

- A. Filler for Nonpotable Water Containment Structures:
  - 1. Pourable, two-component, cold-applied compound meeting ASTM C920, Type M, Grade P, Class 25, Use T.
  - 2. Color: Black.
  - 3. Manufacturer and Product: W.R. Meadows, Inc.; Gardox; or Approved Equal.

## **2.05 ACCESSORIES**

- A. Joint Sealants: As specified in Section 07900.
- B. Nonshrink Grout: As specified in Section 03600.
- C. Roofing Felt: ASTM D226, Type II, 30-pound asphalt-saturated or equal weight of ASTM D227 coal-tar saturated felt.
- D. Reinforcing Steel: As specified in Section 03200.
- E. Nails: Galvanized, as required for securing premolded joint filler.
- F. Masking Tape: As required to temporarily adhere to concrete at each side of joint to receive filler.
- G. Ties for PVC Water Stop: "Hog Rings" or grommets for each edge at 12-inch maximum spacing.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Commence concrete placement after joint preparation is complete.
- B. Time Between Concrete Pours: As specified in Section 03300.

### **3.02 SURFACE PREPARATION**

- A. Construction Joints: Prior to placement of abutting concrete, clean contact surface:
  - 1. Remove laitance and spillage from reinforcing steel and dowels.
  - 2. Roughen surface to minimum of 1/4-inch amplitude:
    - a. Sandblast after concrete has fully cured.
    - b. Water blast after concrete has partially cured.
    - c. Green cut fresh concrete with high pressure water and hand tools.
  - 3. Perform cleaning so as not to damage water stop, if one is present.
- B. Control Joint:
  - 1. Coat concrete surfaces above and below plastic water stop with bond breaker.
  - 2. Do not damage or coat water stop.
- C. Construction Joint with Hydrophilic Water Stop:
  - 1. Follow hydrophilic water stop manufacturer's written instructions.
  - 2. Clean debris, dirt, dust, and foreign material from concrete surface. Concrete surface shall be smooth, clean, and dry. Grind concrete as required.

### **3.03 INSTALLATION OF WATER STOPS**

- A. General:
  - 1. Continuous plastic water stop (as specified) shall be installed in all construction joints in walls and slabs of water holding basins and channels and in walls of below grade structures, unless specifically noted otherwise.
  - 2. Join water stops at intersections to provide continuous seal.
  - 3. Center water stop on joint.
  - 4. Secure water stop in correct position. Tie water stop to reinforcing steel using grommets, "Hog Rings," or tie wire at maximum spacing of 12 inches. Do not displace water stop during concrete placement.
  - 5. Repair or replace damaged water stop.
  - 6. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.
  - 7. Joints in Footings and Slabs:
    - a. Ensure that space beneath plastic water stop is completely filled with concrete.
    - b. During concrete placement, make visual inspection of water stop area.
    - c. Limit concrete placement to elevation of water stop in first pass, vibrate concrete under water stop, lift water stop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
- B. Plastic Water Stop:
  - 1. Install in accordance with manufacturer's written instructions.
  - 2. Splice in accordance with water stop manufacturer's written instructions using Teflon-coated thermostatically controlled heating iron at approximately 380 degrees F.
    - a. Allow at least 10 minutes before new splice is pulled or strained in any way.
    - b. Finished splices shall provide cross-section that is dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
    - c. Field splice permitted only for straight butt welds.
  - 3. Wire looped plastic water stop may be substituted for plastic water stop.

- C. Hydrophilic Water Stop:
  - 1. Install in accordance with manufacturer's written instructions.
  - 2. Provide minimum of 2-1/2 inches of concrete cover over water stop. When structure has two layers of reinforcing steel, locate centered between layers of steel or as shown.
  - 3. Apply adhesive to concrete surface and allow to dry for specified time before applying water stop strip.
  - 4. Butt ends of water stop strip together at splices and corners and join with sealant.
  - 5. Verify that water stop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with water stop.

### **3.04 MANUFACTURER'S SERVICES**

- A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

### **3.05 FIELD QUALITY ASSURANCE AND QUALITY CONTROL**

- A. Owner-Furnished Quality Assurance, in accordance with SBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan in the Drawings. Contractor responsibilities and related information are included in Section 01420.
- B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01410.

**END OF SECTION**

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## SECTION 03300

### CAST IN PLACE CONCRETE

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies the requirements for cast-in-place reinforced concrete including embedded material and formwork.
- B. All concrete structures indicated in the Drawings are to be cast- in-place unless specifically designated as precast, shotcrete or other.
- C. All concrete surfaces exposed to public view are designated Architectural Concrete: conform to Architectural Concrete found in ACI 301 and ACI 303.1.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ACI 117	Specification for Tolerances for Concrete Construction and Materials and Commentary
ACI 207	Cooling and Insulating Systems for Mass Concrete
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 223R	Guide for the Use of Shrinkage-Compensating Concrete
ACI 224R	Control of Cracking in Concrete Structures
ACI 301	Specifications for Structural Concrete
ACI 302.1R	Guide for Concrete Floor and Slab Construction
ACI 303.1	Standard Specification for Cast-in-Place Architectural Concrete
ACI 303R	Guide to Cast-in-Place Architectural Concrete Practice
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 304.2	Placing Concrete by Pumping Methods
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 308.1	Specification for Curing Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 336.1	Specification for the Construction of Drilled Piers
ACI 336.3R	Design and Construction of Drilled Piers
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39/C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	Standard Specification for Ready-Mixed Concrete
ASTM C143/C143M	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150	Standard Specification for Portland Cement

<u>Reference</u>	<u>Title</u>
ASTM C173/C173M	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C494/C494M	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C1059	Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D1709	Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E1745	Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

B. Concrete construction shall conform to requirements of ACI 117 and ACI 301, except as modified herein.

C. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
2. Mix designer: Licensed professional engineer registered in the state of Washington or Washington State DOT approved mix designer.
3. Flatwork Finisher: Unless otherwise permitted, at least one person on finishing crew shall be certified as an ACI Flatwork Finisher, or equivalent.
4. Testing Agency: Unless otherwise permitted, an independent agency, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
  - a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Thermal Control Plan: When required, shall include the following minimum requirements:

1. Calculated or measured adiabatic temperature rise of concrete.
2. Upper limit for concrete temperature at time of placement.
3. Description of specific measures and equipment that will be used to ensure maximum temperature in placement will not exceed specified maximum temperature limit.
4. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.
5. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit.
6. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences.



7. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences.
  8. Drawing showing locations for temperature sensors in placement.
  9. Description of format and frequency of providing temperature data to Engineer.
  10. Description of measures to address and reduce excessive temperatures and temperature differences, if they occur.
  11. Description of curing procedures, including materials and methods, and curing duration.
  12. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained.
  13. Alternate temperature limits when permitted by Engineer.
    - a. Determination of alternate temperature limits shall be based on detailed thermal and crack analyses.
    - b. Analyses shall be stamped by Contractor's Licensed Design Engineer.
  14. If concrete design mixture is changed, thermal control plan shall be updated.
- E. Mockup Panels:
1. Construct one panel for each form liner type specified in Section 03100.
  2. Before concrete work starts, construct panels with specified materials, forming systems, reinforcing details, and leakage prevention techniques.
  3. Show architectural details, joints, form ties, form liners, and rebar spacers to produce finished surface required.
  4. Test form release agent on one mockup panel to ensure no adverse effects are caused on form or form liner materials.
  5. Cast panels from minimum of 3-cubic-yard truck mixer load.
  6. Surface finish and color shall be uniform in appearance to Samples.
  7. Approved panels shall establish standards of quality by which Work will be judged. Replace panels if not representative of Work as specified.
  8. Use mockup panel(s) or portion of as-cast wall surface as selected by Project Representative to develop and test patching techniques and mixes.
    - a. Obtain Project Representative approval prior to using material to repair project structures.
    - b. Demonstrate application, curing, and finishing procedures of repair material.
    - c. Approved repairs shall establish standards of quality by which Work will be judged.
- F. Preinstallation Conference:
1. Required Meeting Attendees:
    - a. Contractor, including pumping, placing and finishing, and curing subcontractors.
    - b. Ready-mix producer.
    - c. Admixture representative.
    - d. Testing and sampling personnel.
    - e. Project Representative.
    - f. Engineer who authored Statement of Special Inspection Plan or Engineer's designee.
  2. Schedule and conduct prior to incorporation of respective products into Project. Notify Project Representative of location and time.
  3. Agenda shall include:
    - a. Architectural concrete requirements.
    - b. Admixture types, dosage, performance, and redosing at Site.
    - c. Mix designs, test of mixes, and Submittals.
    - d. Placement methods, techniques, equipment, consolidation, and form pressures.
    - e. Slump and placement time to maintain slump.
    - f. Finish, curing, and water retention.
    - g. Thermal control plan.
    - h. Protection procedures for weather conditions.
    - i. Other specified requirements requiring coordination.
  4. Responsible for the conference minutes and distribute minutes to the attendees in accordance with Section 01200.

- G. Preinstallation conference for oversized concrete placements:
  - 1. Required meeting attendees:
    - a. Contractor including pumping, placing and finishing, and curing subcontractors.
    - b. Ready-mix producer.
    - c. Testing and sampling personnel.
    - d. Project Representative.
  - 2. Schedule and conduct meeting prior to beginning work on the facility affected. Notify Project Representative of location and time 4 days in advance of the meeting date.
  - 3. Agenda shall include:
    - a. Construction joint layout and sequence of placement.
    - b. Any variations in concrete mix design.
    - c. Placement schedule.
    - d. Procedures for maintaining continuity of placement, and for installing additional construction joint bulkheads with waterstops in case of unexpected delays in placement.
    - e. Method for maintaining concrete temperature below 85 degrees F at time of placement.
    - f. Method to ensure adequate water curing for walls and slabs, as specified in Section 03370.
    - g. Other specified requirements requiring coordination.
  - 4. Responsible for the conference minutes and distribute the minutes to the attendees in accordance with Section 01200.
- H. Maintain one copy of each document on site.

### **1.03 SUBMITTALS**

- A. Section 01300: Procedure.
- B. Product data: Admixtures, bonding agent, bond breaker, and patching materials.
- C. Design data: Concrete mix designs signed by qualified mix designer. Include:
  - 1. Proportions by weight of all ingredients in mix.
  - 2. Solid volume calculations of all ingredients.
  - 3. Air content.
  - 4. Water-cementitious ratio.
  - 5. Trial mix cylinder compressive strengths at 3, 7, and 28 days in accordance with ACI 301.
  - 6. Provide concrete mix design and design data for each facility. Same concrete mix design can be used for multiple facilities.
    - a. Changes to accepted mix design proportions and change in source of any constituent shall require acceptance of a new set of trial mixture tests.
- D. Gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve size.
- E. Detailed plan for cold weather curing and protection of concrete placed and cured in weather below 40 degrees F.
- F. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
- G. Concrete repair methods and materials.
- H. Detailed plans for oversized concrete placements, if elected.
  - 1. Construction joint layout including location of all waterstops, and sequence of placement.
  - 2. Any variations in concrete mix design.
  - 3. Procedures for maintaining continuity of placement, and for installing additional construction joint bulkheads with waterstops in case of unexpected delays in placement.
  - 4. Placement schedule.

5. Procedures for oversized placements shall also include provision of sufficient workmen and standby equipment such as additional concrete pumps to ensure continuous placement of fresh concrete, even in the event of equipment breakdown.
  6. Method of maintaining concrete temperature below 85 degrees F at time of placement.
  7. Method to ensure adequate water curing.
- I. Thermal Control Plan: For mass concrete.
- J. Work plan for placement and finishing of severely sloped floor areas of settling tanks.
- K. Manufacturer's application instructions for bonding agent and bond breaker.
- L. Manufacturers' Certificate of Compliance:
1. Portland cement.
  2. Admixtures.
  3. Fly ash.
  4. Ground granulated blast furnace slag.
  5. Aggregates.
  6. Bonding agent.
  7. Bond breaker.
  8. Patching materials.
  9. Admixtures: Manufacturers' Certificate of Proper Installation.
- M. Statements of qualification:
1. Mix designer.
  2. Batch plant.
  3. Flatwork Finisher
  4. Testing Agency
- N. Test reports:
1. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture, fly ash, and ground granulated blast furnace slag.
  2. Source test analysis report for fly ash and ground granulated blast furnace slag, including percentage of chloride content.
  3. Statement identifying aggregates reactivity. Determine water soluble chloride in each component of aggregates in accordance with ASTM C1218.
  4. For each trial concrete mix design and signed by a qualified mix designer.
  5. Cylinder compressive test results for laboratory concrete mixes.
  6. Water leakage test results
- O. Concrete delivery tickets:
1. For each batch of concrete before unloading at Site.
  2. Record of drum revolution counter, type, brand, test certification, amount of fly ash and/or ground granulated blast furnace slag if used in accordance with ASTM C94, Section 16.
- P. Mock-up panels.

#### **1.04 DEFINITIONS**

- A. Architectural concrete: Concrete indicated as such in Contract Documents. Requires specified care in selection of concrete materials, forming, placing, and finishing in order to obtain desired architectural appearance.
- B. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.

- C. Defective areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16 inch, cracks 0.005 inch wide and larger as well as any crack that leaks for liquid containment basins and below-grade habitable spaces; cracks 0.010 inch wide and larger in nonfluid holding structures, spalls, chips, air bubbles greater than 3/4 inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning. Pinholes and bug holes smaller than 3/4 inch in diameter are not considered as defective areas.
- D. Exposed concrete: Concrete surfaces that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.
- E. Hot Weather: As defined in ACI 305.1.
- F. Hydraulic structures: Liquid containment basins.
- G. New concrete: Less than 60 days old.
- H. Oversized placement: A large monolithic concrete placement exceeding the limits for construction joint spacing as specified in Article Placing Concrete.
- I. Slurry concrete: Mixture of sand, 3/8 inch minus aggregate, cement, and water for wall construction joints and post-tensioned circular concrete tank wall base.
- J. Mass Concrete: Concrete elements greater than 3 feet thick.

## 1.05 WARRANTY

- A. For the Work of this Section, provide all warranties as described in the General Conditions 00700, Subsection 7.9B, and provide all normal commercial warranties available, as described in the General Conditions.

## PART 2 PRODUCTS

### 2.01 CONCRETE MATERIALS

- A. Cement: Furnish from one source for the Project.
    - 1. Portland cement Type II:
      - a. Meet ASTM C150/C150M.
      - b. Alkalies: Maximum 0.60 percent.
      - c. Tricalcium aluminate content of Type I cement: Maximum 12 percent.
      - d. Non-hydraulic above grade structures: Type I or Type II cement.
      - e. Hydraulic and below grade structures and sewers: Type II cement or combination of Type I mixed with fly ash.
      - f. Combine fly ash with cement at batch plant or during production of cement in accordance with ASTM C595, Type IP cement.
    - 2. Supplementary Cementitious Materials (SCM):
      - a. Fly Ash: Class F fly ash in accordance with ASTM C618, except as modified herein:
        - 1) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
        - 2) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
        - 3) Water requirement: Maximum 100 percent of control.
- $$\frac{CaO(\%) - 5}{FE_2O_3(\%)} : \text{Maximum } 1.5$$

- 4) ASTM C618, Table 3, Reactivity with Cement Alkalies, apply when aggregate or portions of aggregate is reactive as specified under Paragraph Nonpotentially Reactive.
  - 5) For fly ash not meeting requirements of chemical ratio listed above, furnish the following:
  - 6) Test fly ash in accordance with ASTM C1012.
  - 7) Furnish test data confirming fly ash in combination with cement used meets strength requirements, is compatible with air-entraining agents and other additives, and provides increased sulfate resistance equivalent to or better than Type II cement.
  - 8) Conduct tests using proposed fly ash and cement samples together with control samples using Type II cement without fly ash.
  - 9) Do not add fly ash to concrete slabs designated to receive polished concrete finish.
  - b. Calcined Pozzolan: ASTM C618, Class N.
  - c. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120, except as modified herein:
    - 1) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
    - 2) GGBFS supplied for the mix designs for each facility shall be from the same single source, otherwise test mixes shall be redone.
    - 3) Slag Color: Uniformly light gray.
- B. Aggregates: Furnish from one source for the Project.
1. Natural aggregates:
    - a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
    - b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
    - c. Do not use aggregate known to cause excessive shrinkage.
  2. Non-potentially reactive: In accordance with ASTM C1260, maximum expansion in 14 days shall be 0.10 inch.
  3. Aggregate soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
  4. Fine aggregates:
    - a. Clean, sharp, natural sand.
    - b. ASTM C33.
    - c. Materials passing No. 200 sieve: 4 percent maximum.
    - d. Limit deleterious substances in accordance with ASTM C33, Table 2 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
  5. Coarse aggregate:
    - a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
    - b. Materials Passing 200 Sieve: 0.5 percent maximum.
    - c. Limit deleterious substances in accordance with ASTM C33, Table 3 for exposed concrete.
- C. Admixtures: Furnish from one manufacturer for the Project.
1. Characteristics:
    - a. Compatible with other constituents in the concrete mix and free of chlorides or other corrosive chemicals.
    - b. Furnish type of admixture as recommended by manufacturer for anticipated temperature changes.
  2. Air-entraining admixture:
    - a. ASTM C260, nontoxic after 30 days and contains no chlorides.
    - b. Concrete with air-entrainment admixture added shall maintain air percentage as batched, within plus or minus 2 percent for time required for placement into structure.
  3. Water-reducing admixture: ASTM C494, Type A or Type D.
    - a. Approved manufacturers:
      - 1) BASF Admixtures, Inc., Cleveland, OH; Pozzolith Series or Polyheed Series.

- 2) Grace Construction Products, Cambridge, MA; Duracem Series or Mira Series.
- 3) Euclid Chemical Co., Cleveland, OH; Eucon Series.
- 4) Approved Equal.
4. High range water reducing admixture (superplasticizer):
  - a. ASTM C494.
  - b. Hold slump of 5 inches or greater for time required for placement.
  - c. Furnish type as recommended by manufacturer for allowed temperature ranges.
  - d. Type F or G.
  - e. Approved manufacturers:
    - 1) BASF Admixtures Inc., Shakopee, MN; Glenium Series, PS 1460, or Rheobuild 1000
    - 2) Grace Construction Products, Cambridge, MA; Daracem Series.
    - 3) Euclid Chemical Co., Cleveland, OH; Eucon Series.
    - 4) Approved Equal.
5. Shrinkage-reducing admixture:
  - a. Provides at least 80% shrinkage reduction as measured and documented by field performance and testing.
  - b. Dosage rate and mixing sequence shall be per manufacturer's recommendations.
  - c. Shall have documented performance of ASTM C1581 and exhibit no cracking for a minimum of 120 days.
  - d. Furnish only in concrete of Area 500 slab at approximate elevation of 126.25.
  - e. Approved manufacturers:
    - 1) Premier CPG, West Conshohocken, PA; PREVent-C. No substitutions allowed.
6. Hydrophobic Concrete Admixture
  - a. Meets or exceeds British Standards Institute (BSI) 1881-122 testing to performance of 1.00% water absorption.
  - b. Dosage as recommended by manufacturer to achieve specified water absorption.
  - c. Furnish only in concrete for rain monument foundation.
  - d. Acceptable products:
    - 1) Hycrete, Inc., Carlstadt, New Jersey, Hycrete W1000. No substitutions allowed.
7. Color pigments for duct banks: Inert, mineral or metaloxide pigments, either natural or synthetic; resistant to lime and other alkalies.

D. Water: Clean and potable containing less than 500 ppm of chlorides.

## 2.02 ANCILLARY MATERIALS

- A. Bonding agent:
  1. ASTM C881, Type V.
  2. Furnish two-component, 100% solids epoxy epoxy.
  3. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
  4. Approved manufacturers:
    - a. BASF Building Systems, Shakopee, MN; Concreate.
    - b. Sika Chemical Corp., Lyndhurst, NJ; Sikadur 32.
    - c. Euclid Chemical Co., Cleveland, OH; Euco Epoxy System.
    - d. Contech Services, Inc., Seattle, WA.
    - e. Approved Equal.
- B. Bond breaker:
  1. Nonstaining type, providing positive bond prevention.
  2. Approved manufacturers:
    - a. Nox-Crete Chemicals, Inc; Omaha, NE, Silocseal Select.
    - b. Edoco Inc., Long Beach, CA, Burke Clean Lift Bond Breaker or Burke Tilt Free Bond Breaker.
    - c. Approved Equal.

- C. Repair Material:
  - 1. Vertical and overhead concrete surfaces in accordance with Section 03720.
  - 2. Horizontal concrete surfaces in accordance with Section 03722.
- D. Crack repair epoxy manufacturers: As specified in Section 03740.
- E. Non-Shrink Grout: Comply with the requirements of ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents and that of Section 03600.
- F. Curing Materials: Contractor selected method and materials shall be in conformance with the requirements of ACI 301 Section 5.

## 2.03 CONCRETE MIX DESIGN

- A. Proportioning Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Verify required average strength for each type of concrete on the basis of trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ an experienced independent testing agency acceptable to Project Representative for testing and reporting proposed mix designs.
- C. Admixtures: Admixtures to be used in the concrete mix shall be incorporated into the mix design. Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer. For concrete containing the PREVent-C shrinkage-reducing admixture, it shall be added in powder form (do not premix with water) after all other admixtures have been added.
- D. Fiber Reinforcement: If specified, add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
- E. Normal Weight Concrete:
  - 1. Compressive strength
    - a. 4,500 psi at 28 days and 5000 psi at 56 days, unless otherwise shown.
    - b. 3,000 psi at 28 days and 4000 psi at 56 days for secondary concrete elements such as curbs, sidewalks, and pipe/conduit/duct bank encasements.
    - c. Design lab-cured trial mix cylinders.
    - d. Use additional cement or cement plus cementitious additives above minimum specified if required to meet average compressive strength, F'cr.
    - e. Use F'cr as basis for selection of concrete proportions as set forth in ACI 301.
    - f. F'cr: Equal to F'c plus 1,200 when data are not available to establish standard deviation.
  - 2. Maximum Aggregate Size: 1-1/2 inch.
    - a. Structural slabs and walls 12 inches thick or less: 3/4 inch maximum aggregate size.
    - b. Secondary concrete elements: 3/4 inch maximum aggregate size.
- F. Concrete for secant piles.
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4000 psi.
  - 2. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
  - 3. Slump: 8 inches +/- 1 inch.
  - 4. Maximum Aggregate Size: 3/4 inch.
  - 5. All Secant Pile concrete shall be in accordance with the requirements of ACI 336.1 for concrete to be placed by the slurry displacement method.
- G. Tremie Concrete: In accordance with Section 03302.

H. Concrete fill:

1. Design for 2,500 psi at 28 days using 1-inch aggregate, 4-inch maximum slump and 0.46 maximum water-cement ratio.
2. Use water-reducing admixture.

I. Proportions:

1. Design mix to meet aesthetic and structural concrete requirements.
2. In accordance with ACI 211.1, unless specified otherwise.
3. Unless specifically stated otherwise, water-cement ratio (or water-cement plus cementitious additive ratio) shall control amount of total water added to concrete as follows:

Water-Cement Ratio		
Coarse Aggregate Size	Maximum W/C Ratio w/ Superplasticizer	Maximum W/C Ratio w/o Superplasticizer
1-1/2"	0.40	0.42
1"	0.40	0.42
3/4"	0.40	0.42

4. Minimum cement content (or combined cement plus cementitious additive content when cementitious additives are used):
  - a. 517 pounds per cubic yard for concrete with 1-1/2-inch maximum size aggregate.
  - b. 540 pounds per cubic yard for 1-inch maximum size aggregate.
  - c. 564 pounds per cubic yard for 3/4-inch maximum size aggregate.
  - d. Increase cement content or combined cement plus cementitious additive content, as required to meet strength requirements and water-cement ratio.
  - e. Unless otherwise permitted, limit cementitious materials content to 100 pounds per cubic yard greater than specified minimum cementitious materials content in mix design.

J. Cementitious additives:

1. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
  - a. Slag Cement: 50 percent.
  - b. Combined Fly Ash and Slag Cement: 50 percent, with fly ash not exceeding 25 percent.
  - c. Minimum supplementary cementitious material content: 45 percent, with fly ash not exceeding 25 percent.

K. Admixtures:

1. Air content:
  - a. 4 to 6 percent when tested in accordance with ASTM C231
  - b. 3 percent maximum for interior slabs to receive hard-troweled finish, or where heavy-duty concrete floor finish is required.
2. Water reducers: Use in all concrete.
3. High range water reducers (superplasticizers): Use in wall concrete. Control slump and workability to at least 4-1/2-inch slump at discharge into forms by adjusting high range water reducer at batch plant.

L. Slump range at site:

1. 4-1/2 inches minimum, 8 inches maximum for concrete with a high range water reducing admixture.
2. 3 inches minimum and 5 inches maximum for concrete without high range water reducing admixture.



- M. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.†	Air Content (%)*
3/8	7.5
1/2	7.0
3/4	6.0
1	6.0
1-1/2	5.5
2§	5.0
3§	4.5

†See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.

\*Tolerance of air content is  $\pm 1\frac{1}{2}$  percent.

§Air contents apply to total mixture. When testing concretes, however, aggregate particles larger than 1-1/2 inches are to be removed by sieving and air content will be measured on sieved fraction (tolerance on air content as delivered applies to this value). Air content of total mixture is computed from value measured on the sieved fraction passing the 1-1/2-inch sieve in accordance with ASTM C231/C231M.

- N. Combined aggregate gradation:
- Structures: Either 1-1/2-inch maximum grading or 1-inch maximum grading.
  - Combined gradation limits: In accordance with ASTM C33.

## 2.04 CONCRETE MIXING

- A. General: In accordance with ACI 304R.
- B. Concrete mix temperatures: As shown below for various stages of mixing and placing:

CONCRETE TEMPERATURES				
Ambient Air Temp.	Concrete Member Size, Minimum Dimension			
	<12"	12"-36"	36"-72"	>72"
Minimum concrete temperature as mixed for indicated air temperature:				
Above 30 deg. F	60 deg. F	55 deg. F	50 deg. F	45 deg. F
0 to 30 deg. F	65 deg. F	60 deg. F	55 deg. F	50 deg. F
Below 0 deg. F	70 deg. F	65 deg. F	60 deg. F	55 deg. F
Maximum allowable gradual temperature drop in first 24 hours after curing period and after end of protection:				
—	50 deg. F	40 deg. F	30 deg. F	20 deg. F

- C. Truck mixers:
- Equip with electrically actuated counters to readily verify number of revolutions of drum or blades.
  - Counter:
    - Resettable, recording type, mounted in driver's cab.
    - Actuated at time of starting mixers at mixing speeds.
  - Truck mixer operation shall furnish concrete batch as discharged that is homogeneous with respect to consistency, mix, and grading.
  - If slump tests taken at approximately 1/4 and 3/4 points of load during discharge give slumps differing by more than 2 inches when specified, slump is more than 4 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

5. Before attempting to reuse unit, check mechanical details of mixer, such as water measuring, and discharge apparatus, condition of blades, speed of rotation, general mechanical condition of unit, admixture dispensing equipment, and clearance of drum.
6. Do not use non-agitating or combination truck and trailer equipment for transporting ready-mixed concrete.
7. Concrete volume in truck:
  - a. Limit to 63 percent of total volume capacity in accordance with ASTM C94 when truck mixed.
  - b. Limit to 80 percent of total volume capacity when central mixed.
8. Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer.
9. Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
10. Place materials, including mixing water, in mixer drum before actuating revolution counter for determining number of mixing revolutions.

D. Aggregates: Thoroughly and uniformly wash before use.

E. Admixtures:

1. Air-entraining admixture: Add at plant through manufacturer-approved dispensing equipment.
2. Water reducers: Add prior to addition of high range water reducing admixture (superplasticizers).
3. High range water reducing admixture (superplasticizers) and Air-Entraining Admixtures:
  - a. Add at concrete plant only through equipment furnished or approved by admixture manufacturer.
  - b. Accomplish variations in slump, working time, and air content for flowable mixes by increasing or reducing high range water reducing admixture (superplasticizers) dose or air-entraining admixture dose at ready-mix plant only.
  - c. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
  - d. Add discharge amount to each load of concrete into separate dispensing container, verify amount is correct, and add to concrete.
  - e. Additional dosage of high range water reducing admixture (superplasticizers) may be added in field using manufacturer-approved dispensing when unexpected delays cause too great of slump loss.

## 2.05 SOURCE QUALITY CONTROL

- A. Cement: Test for total chloride content.
- B. Fly ash: Test in accordance with ASTM C311.
- C. Ground Granulated Blast Furnace Slag Test in accordance with ASTM C989.
- D. Batch plant inspection: Project Representative shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in these Specifications.
  1. Weighing scales: Tested and certified within tolerances set forth in the National Bureau of Standards Handbook No. 44.
  2. Batch plant equipment: Either semiautomatic or fully automatic in accordance with ASTM C94.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this Section. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Place no concrete until all embedded conduits, utilities and other components are recorded on the record drawings and a photographic image made to document the item's presence. Submit photographs.

### **3.02 PREPARATION**

- A. Formwork:
  - 1. Verify reveals and other design elements are properly laid out.
  - 2. Verify that forms are clean and free of rust before applying release agent.
  - 3. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.
  - 4. Rigidly close openings in formwork.
  - 5. Support formwork against movement during placement of concrete.
  - 6. Wet wood forms sufficiently to tighten up cracks; wet other material sufficiently to maintain workability of the concrete.
- B. Prepare previously placed concrete by sandblast cleaning and applying bonding agent in accordance with manufacturer's instructions.
- C. 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.
- D. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping joints, edges and ends. Cover with sand to depth indicated in the Drawings; repair damaged vapor retarder before covering.

### **3.03 CONVEYING**

- A. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Allow no cold joints to form.
- B. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to dropping, rehandling and flowing.
- C. Do not use concrete which becomes non-plastic and unworkable, or does not meet required quality control limits, or has been contaminated by foreign materials.
- D. Remove concrete from the work site that does not meet specifications.
- E. Unless otherwise noted herein or by any of the Referenced Standards, convey all concrete in accordance with the requirements of ACI 301.
- F. Convey exposed to public view concrete (Architectural Concrete) in accordance with ACI 301 as modified by ACI 303.1, Section 2.3.2 Conveying and placement.

### 3.04 PLACING CONCRETE

- A. Preparation: Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.
- B. Inspection: Notify Project Representative at least 3 days in advance before starting to place concrete.
- C. Discharge time:
  - 1. As determined by set time, do not exceed 1-1/2 hours after adding cement to water unless special approved time delay admixtures are used. Coordinate time delay admixture information with manufacturer and Project Representative prior to placing concrete.
  - 2. Adjust slump or air content at Site by adding admixtures for particular load when approved by Project Representative. Then, adjust plant dosage for remainder of placement. Additional dosage at Site shall be through approved dispenser supplied by admixture manufacturer.
  - 3. Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of high range water reducing admixture (superplasticizers) and provide new mix design if it fails to maintain slump between 4 to 8 inches and produce good consolidation for the length of time required. Redesign mix adjusting set control admixtures to maintain setting time in range required.
- D. Placement into formwork:
  - 1. Before depositing concrete, remove debris from space to be occupied by concrete.
  - 2. Prior to placement of concrete, dampen fill under slabs on ground, dampen sand where vapor retarder is specified, and dampen wood forms.
  - 3. Reinforcement: Secure in position before placing concrete.
  - 4. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
  - 5. Use placement devices, for example, chutes, pouring spouts, and pumps.
  - 6. Vertical free fall drop to final placement: 5 feet in forms 8 inches or less wide and 8 feet in forms wider than 8 inches, except as specified.
    - a. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
    - b. Limit free fall to prevent segregation caused by aggregates hitting reinforcing steel.
  - 7. Do not use aluminum conveying devices.
  - 8. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
  - 9. Joints in footings and slabs:
    - a. Ensure space beneath plastic water stop completely fills with concrete.
    - b. During concrete placement, make visual inspection of entire water stop area.
    - c. Limit concrete placement to elevation of water stop in first pass, vibrate concrete under water stop, lift water stop to confirm full consolidation without voids, place remaining concrete to full height of slab.
    - d. Apply procedure to full length of water stops.
  - 10. If reinforcement is in direct sunlight or is more than 20 degrees F higher in temperature than concrete temperature before placement, wet reinforcement with water fog spray before placing concrete to cool reinforcement.
  - 11. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.
- E. Conveyor belts and chutes:
  - 1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
  - 2. Do not use chutes longer than 50 feet.
  - 3. Minimum slopes of chutes: Angled to allow concrete to readily flow without segregation.

4. Conveyor belts:
  - a. Accepted by Project Representative.
  - b. Wipe clean with device that does not allow mortar to adhere to belt.
  - c. Cover conveyor belts and chutes.
- F. Retempering: Not permitted for concrete where cement has partially hydrated.
- G. Pumping of concrete:
  1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
  2. Minimum Pump Hose (Conduit) Diameter: 4 inches.
  3. Replace pumping equipment and hoses (conduits) that are not functioning properly.
- H. Maximum size of concrete placements:
  1. Limit size of each placement to allow for strength gain and volume change due to shrinkage.
  2. Locate expansion, control, contraction, and construction joints where shown. When expansion or control joints are not shown, provide construction joints at maximum spacing of 40 feet. When expansion or control joint spacing exceeds 60 feet, provide intermediate construction joints at maximum spacing of 40 feet. Uniformly space construction joints. Vertical construction joint shall not be greater than 20 feet from wall corners or intersections.
  3. Location of construction joints for the post-tension circular concrete tanks are shown on the Drawings and cannot be changed.
  4. Contractor may elect to make oversized concrete placements with construction joints at increased spacing in order to expedite construction schedule, if accepted by Project Representative. When expansion joint spacing exceeds 120 feet, provide intermediate construction joints for oversized wall and elevated slab placements at a maximum spacing of 60 feet and for oversized base slab placement at a maximum spacing of 80 feet. Vertical construction joints for oversized wall placements shall not be greater than 30 feet from wall corners or intersections. Submit plan for oversized concrete placements prior to starting work.
  5. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
  6. Cold joints below finished water surface shall be avoided. If required, obtain Project Representative's approval. Should placement sequence result in cold joint located below finished water surface, install water stop in joint.
- I. Minimum time between adjacent placements:
  1. Construction joints: 14 days (7 days wet cure and 7 days dry cure, and a minimum 75 percent compressive strength).
  2. Control joints: 6 days.
  3. Expansion joints: 1 day.
  4. At least 2 hours shall elapse after depositing concrete in long columns and walls thicker than 8 inches before depositing concrete in beams, girders, or slabs supported thereon.
  5. For columns and walls 10 feet in height or less, wait at least 45 minutes prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.
- J. Removal of water: Unless tremie method for placing concrete is specified, remove water from space to be occupied by concrete.
- K. Consolidation and visual observation:
  1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude as required to consolidate concrete in section being placed.
  2. Provide at least one standby vibrator in operable condition at placement Site prior to placing concrete.
  3. Consolidation equipment and methods: ACI 309R.

4. Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.
5. Vibration consolidation shall not exceed distance of 3 feet from point of placement.
6. Vibrate concrete in vicinity of joints to obtain impervious concrete.

L. Hot weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
2. Placement frequency shall be such that lift lines will not be visible in exposed or architectural concrete finishes.
3. Maintain concrete temperature below 85 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking due to heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
4. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
5. Prevent differential temperature between reinforcing steel and concrete.
6. Evaporation Retardant: As specified in Section 03370.

M. Cold weather placement:

1. Do not place concrete when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling, without special protection as specified or accepted by Project Representative.
2. Do not place concrete against frozen earth or ice, or against forms and reinforcement with frost or ice present.
3. Provide heated enclosures when air temperatures are below 40 degrees F.
4. Maintain surface temperature of concrete above 40 degrees F and cure concrete as specified in Section 03370 for minimum of 7 days.
5. Provide maximum and minimum thermometers placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work.
6. In accordance with ACI 306.1 and ACI 301.
7. External heating units:
  - a. Vent heating units to atmosphere and do not locally heat or dry concrete. Where water cure is specified, maintain wet condition.
  - b. Do not exhaust heater flue gases, (causes concrete carbonation due to concentrated carbon dioxide,) directly into enclosed area.
8. Maintain curing conditions as specified in Section 03370.

### 3.05 CONCRETE CURING

- A. In accordance with Section 03370.

### 3.06 MASS CONCRETE PLACEMENT AND THERMAL CONTROL

A. General:

1. During placement of concrete, thermal control measures shall be in place to limit the maximum initial concrete temperature rise to 20 degrees F during placement. The maximum allowable temperature of the concrete shall be 135 degrees F.
2. Difference in temperature between concrete interior and surface temperatures shall not exceed 35 degrees F.
3. Install a temperature monitoring system to measure temperatures within the interior and at the surface of the concrete.
4. The interior of the concrete shall be allowed to cool down and stabilize and shall be a minimum of 14 days from the time of placement.
5. No mass concrete placement may occur until the Contractor has obtained written approval of the Thermal Control Plan from the Project Representative.

- B. Pre-Cooling of the Concrete Mix: Pre-cooling of the concrete mix prior to placement may be attained by the following means:
  - 1. Batch water shall be cooled and ice may be substituted for a portion of the batch water.
  - 2. All aggregates shall be shaded to prevent heat absorption.
  - 3. Cement shall be shaded to prevent heat absorption.
  - 4. Coarse aggregate stockpiles shall be sprayed with water for an evaporative cooling effect.
  - 5. Nitrogen dousing or other alternative means proposed by the Contractor and accepted by the Project Representative.
- C. Cooling During Concrete Placement: Use fog sprayers to reduce the ambient air temperature during placement. Adjust the water content of the concrete to account for any added water.
- D. Post-Cooling of the Concrete Mix:
  - 1. Concrete shall be water cured as soon as possible following placement per the requirements of Section 03370.
  - 2. The temperature of the interior and surfaces of the concrete shall be continuously monitored during the cooling period.
  - 3. The cooling period is defined as the time required for the interior of the concrete placement to stabilize and shall be a minimum of 14 days from the time of placement.
  - 4. At the Contractors option, use embedded thin walled piping and circulating water to control heat gain in the previously cast concrete. Clearly indicate in the temperature control plan if cooling piping will be embedded in the concrete. The embedded piping shall not be installed within the top 20 inches of the slab or wall. The cooling pipe system shall be operated for the duration of the cooling period.

### **3.07 FIELD QUALITY CONTROL**

- A. General:
  - 1. Special inspection of concrete in accordance with Section 01410 and SBC Chapter 17.
  - 2. Concrete shall be tested by independent testing agency retained by County.
  - 3. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
  - 4. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, Samples used shall be taken from discharge end of pump hose.
  - 5. Evaluation will be in accordance with ACI 301 and Specifications.
  - 6. Specimens shall be made, cured, and tested in accordance with ASTM C31 and ASTM C39. 6-inch diameter by 12-inch high specimens are required for concrete with 1-1/2 inch maximum aggregate size. 4-inch diameter by 8-inch high specimens are acceptable otherwise.
  - 7. Frequency of testing may be increased at discretion of Project Representative.
  - 8. Pumped concrete: Take concrete samples for slump (ASTM C143) and test cylinders (ASTM C31 and C39).
  - 9. Reject concrete represented by cylinders failing to meet strength and air content specified.
- B. Concrete Strength Test:
  - 1. Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter test specimens at age of 28 days for acceptance.
  - 2. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified in Section 03370, by 7 additional days.
  - 3. For concrete with specified 56-day strength: two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 56 days for acceptance. Should results of 28-day tests meet specified requirement for 56-day strength, 56-day tests will not be required.
  - 4. Provide a minimum of one spare test specimen per sample. Test spare cylinder as directed by Engineer.

- C. Shrinkage Tests:
1. When required to conform to shrinkage limits, collect actual concrete materials being batched and before liquids have been added to mix.
  2. Mix sampled material in a laboratory at proportions matching batched concrete.
  3. Test shrinkage characteristics every 5,000 cubic yards of concrete used on job and every 3 months during construction when compression test cylinders are made.
  4. Concrete Shrinkage Limits: Test in accordance with ASTM C157/C157M, with the following modifications:
    - a. Prisms shall be moist cured for 7 days prior to 28-day drying period.
    - b. Comparator reading at end of 7-day moist cure shall be used as initial length in length change calculation.
    - c. Reported results shall be average of three prisms.
    - d. If drying shrinkage of a specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.
    - e. Results at end of 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used.
    - f. If 7 day or 14 day shrinkage tests results exceed shrinkage limits established by design mix testing, modify concrete mix design to reduce shrinkage prior to casting additional concrete on Project.
- D. High range water reducer (superplasticizer) admixture segregation test: Test each truck prior to use on job.
1. Segregation test objective: Concrete with 4-inch to 8-inch slump shall stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
  2. Test procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.
  3. Reject concrete if mortar or moisture separates and flows out of mix.
- E. Cold weather placement tests:
1. During cold weather concreting, cast cylinders for field curing as follows. Use method that will produce greater number of specimens:
    - a. Six extra test cylinders from last 100 cubic yards of concrete.
    - b. Minimum three specimens for each 2 hours of placing time or for each 100 cubic yards.
  2. These specimens shall be in addition to those cast for lab testing.
  3. Protect test cylinders from weather until they can be placed under same protection provided for concrete of structure that they represent.
  4. Keep field test cylinders in same protective environment as parts of structure they represent to determine if specified strength has been obtained.
  5. Test cylinders in accordance with applicable Sections of ASTM C31 and ASTM C39.
  6. Use test results to determine specified strength gain prior to falsework removal or for prestressing.
- F. Tolerances:
1. Walls: Measure and inspect walls for compliance with tolerances specified in Section 03100.
  2. Slab finish tolerances and slope tolerances:
    - a. Floor flatness measurements shall be made day after floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.
    - b. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
    - c. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.
  3. Areas displaying defective conditions shall be repaired by the Contractor as soon as possible in a manner acceptable to the Project Representative.



- G. Water leakage tests:
1. Purpose: Determine integrity and water tightness of finished exterior and interior water holding concrete surfaces.
  2. Water leakage tests shall be conducted in accordance with ACI 350.1 and as specified herein.
  3. Water leakage tests and concrete repairs shall be completed prior to any coatings applied to the walls or slab.
  4. Test the following structures for water leakage:
    - a. Facility 200: Regulator.
    - b. Facility 400: Ballasted Sedimentation.
    - c. Facility 500: UV Disinfection.
    - d. Facility 600: Solids Holding Tank.
  5. Water-holding structures:
    - a. Perform leakage tests after concrete structure is complete and capable of resisting hydrostatic pressure of water test. Concrete shall have achieved its full design strength.
    - b. Perform leakage test before backfill, brick facing, grout topping slab, coatings, or other work that will cover concrete surfaces has begun.
    - c. Install temporary bulkheads, cofferdams, and pipe blind flanges, and close valves. Inspect each to see that it provides complete seal.
    - d. Fill with water at a rate not to exceed 4ft/hr, to test level shown, or maximum liquid level if no test level is given. Maintain this level for 72 hours prior to start of test to allow water absorption, structural deflection, and temperature to stabilize.
    - e. Measure evaporation and precipitation by floating a partially filled, transparent, calibrated, open top container.
    - f. Measure water surface at two points 180 degrees apart when possible where attachments, such as ladders exist, at 24-hour intervals. Using sharp pointed hook gauge and fixed metal measure capable of reading to 1/100 of an inch. Continue test for period of time sufficient to produce at least 1/2-inch drop in water surface based on assumption that leakage would occur at maximum allowable rate specified or for 72 hours, whichever is lesser time.
  6. Acceptance criteria:
    - a. Volume loss shall not exceed 0.050 percent of contained liquid volume in 24-hour period, correcting for evaporation, precipitation, and settlement.
    - b. No damp spots or seepage visible on exposed surfaces. Damp spot is defined as sufficient moisture to be transferred to dry hand upon touching.
  7. Repairs when test fails: Dewater structure; fill leaking cracks with crack repair epoxy as specified in Section 03740. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until the structure successfully passes the test.
  8. Ensure leakage test is carried out before backfilling or applying barrier coatings to water holding structures.
  9. Water for testing shall be provided by Contractor.
  10. After testing has been completed, dispose of test water in a manner approved by Project Representative.

### **3.08 REPAIRING CONCRETE**

- A. General:
1. Inject cracks that leak with crack repair epoxy as specified in Section 03740.
  2. Repair horizontal concrete surfaces using one of the materials specified in Section 03722. Select system, submit for review, and obtain approval from Project Representative prior to use.
  3. Repair vertical and overhead concrete as specified in Section 03720.
  4. Develop repair techniques with material manufacturer on mock-up panels prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Project Representative.
  5. Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.

6. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Project Representative.
- B. Tie holes:
1. Above-grade, exterior: Install form tie plugs in accordance with Section 03100 or fill with nonshrink grout as specified in Section 03600. Provide setback of grout as shown on the Drawings when indicated in the architectural Drawings to be exposed form ties.
  2. Below-grade fill with nonshrink grout as specified in Section 03600.
  3. Match color of adjacent concrete and demonstrate on mock-up panels first.
  4. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.
- C. Alternate form ties; tapered through-bolts:
1. Mechanically roughen entire interior surface of through hole. Epoxy coat roughened surface and drive elastic vinyl plug to half depth. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03600. Use only enough water to dry pack grout. Dry pack while epoxy is still tacky. If epoxy has dried, remove epoxy by mechanical means and reapply new epoxy.
  2. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.
  3. Provide setback of grout as indicated in the Drawings when indicated in architectural Drawings to be exposed form ties.
- D. Exposed metal objects:
1. Metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, shall be removed by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
  2. Repair area of chipped-out concrete per requirements of Section 03720.
- E. Blockouts at pipes or other penetrations:
1. Install per details indicated in the Drawings or submit proposed blockouts for review.
  2. Use nonshrink, nonmetallic grout, Category I or II as specified in Section 03600.

### **3.09 CONCRETE WALL FINISHES**

- A. Type W-1 (Ordinary Wall Finish):
1. Patch tie holes.
  2. Knock off projections.
  3. Repair defective areas.
  4. Inject cracks in accordance with requirements of Section 03740.
- B. Type W-2 (Smooth Wall Finish):
1. Patch tie holes.
  2. Grind off fins and other projections.
  3. Repair defective areas to provide smooth uniform appearance.
  4. Inject cracks in accordance with requirements of Section 03740.
- C. Type W-5 (Finish for Painting):
1. In accordance with requirements for Type W-2 except as follows:
    - a. Leave surface ready for painting as specified in Section 09900.
- D. Type CONC-2 (Form Liner Finish):
1. As specified in Section 03100.
- E. Type CONC-3 (200 Building Circular Recess)"
1. To receive Medium Sandblast.

### 3.10 CONCRETE SLAB FINISHES

#### A. General:

1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
2. Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Finish slab in accordance with specified slab finish.
4. Do not dust surfaces with dry materials nor add water to surfaces.
5. Cure concrete as specified in this Section.

#### B. Type S-1 (Steel Troweled Finish):

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
2. Wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand steel trowel concrete to produce smooth, smooth dense surface, free from trowel marks.
5. Provide light steel-troweled finish (two trowelings) at air-entrained slabs. Provide hard steel-troweled finish (ringing sound from the trowel) for nonair-entrained slabs.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
7. Power Finishing:
  - a. Approved power machine may be used in lieu of or in addition to hand finishing in accordance with directions of machine manufacturer.
  - b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
  - c. Do first steel troweling for slab S-1 finish by hand.

#### C. Type S-2 (Wood Float Finish):

1. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
2. Wood float finish to compact and seal surface.
3. Remove laitance and leave surface clean.
4. Coordinate with other finish procedures.

#### D. Type S-3 (Underside Elevated Slab Finish): When forming is removed, grind off projections on underside of slab and repair defective areas, including small shallow air pockets where schedule of concrete finishes requires:

1. Prepare surfaces to match Type W-2 (Smooth Wall Finish).

#### E. Type S-5 (Broomed Finish):

1. Finish as specified for Type S-1 floor finish, except use only a light-steel troweled finish, and then finish surface by drawing fine-hair broom lightly across surface.
2. Broom in same direction and parallel to expansion joints, or, in case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

#### F. Type S-6 (Sidewalk Finish):

1. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic or as shown.
4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with grooving tool.

#### G. Concrete Curbs:

1. Float top surface of curb smooth, and finish all discontinuous edges with steel edger.

2. After concrete has taken its initial set, remove front form and give exposed vertical surface an ordinary wall finish, Type W-1.

### 3.11 MANUFACTURER'S SERVICES

- A. Provide the following representative at Site for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
  1. Batch plant representative:
    - a. Observe how concrete mixes are performing.
    - b. Be present during first placement of each type of concrete mix.
    - c. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project.
    - d. Establish control limits on concrete mix designs.
  2. Admixture manufacturer's representative:
    - a. Demonstrate special features, product performance, product mixing, testing, and placement or installation for each type of admixture.
    - b. Observe how concrete mixes are performing.
    - c. Be present during first placement of each type of concrete mix.
    - d. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
    - e. Provide equipment for control of concrete redosing for air entrainment or high range water reducing admixture (superplasticizers) at Site to maintain proper slump and air content if so needed.
  3. Bonding agent manufacturer's representative: Demonstrate product performance, product mixing, and placement.

### 3.12 PROTECTION OF INSTALLED WORK

- A. After curing as specified in this Section, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage as a result of other construction work.
- B. Repair areas damaged by construction, using specified repair materials and approved repair methods.

### 3.13 SCHEDULE OF CONCRETE FINISHES

- A. Form Tolerances: As specified in Section 03100.
- B. Provide concrete finishes as scheduled:

Area	Type of Finish	Required Form Tolerances
<b>Exterior Wall Surfaces</b>		
Abovegrade/exposed (above point 6" below finish grade)	W-2	W-B
Abovegrade/exposed architectural concrete walls	CONC-2	W-B
Abovegrade/covered with brick veneer or other finish material	W-1	W-A
Backfilled/waterproofed (below point 6" below finish grade)	W-1	W-A
Backfilled/not waterproofed (below point 6" below final grade)	W-1	W-A
Walls to receive cementitious coatings	W-4	W-B
<b>Interior Wall Surfaces</b>		
Open top water-holding tanks and basins/not painted or coated	W-2	W-A

Area	Type of Finish	Required Form Tolerances
Covered water-holding tanks and basins/not painted or coated	W-1	W-A
Water-holding tanks, channels, and basins/painted or coated	W-5	W-A
Buildings, pipe galleries, and other dry areas/not painted or coated	W-2	W-A
Buildings, pipe galleries, and other dry areas/painted or coated	W-5	W-A
<b>Exterior Slabs</b>		
Roof slab/exposed	S-5	S-B
Roof slab/covered with roofing material	S-1	S-A
Water-holding tanks and basins/top of wall	S-5	S-B
Top of footing	S-2	S-A
Clarifier slabs	S-2, S-7	S-A
Other water-holding tanks and basins	S-1	S-A
Stairs and landings	S-5	S-B
Sidewalks	S-6	S-B
Other exterior slabs	S-5	S-A
<b>Interior Slabs</b>		
Buildings, pipe galleries, and other dry areas	S-1	S-B
Slabs to receive mortar setting bed for tile	S-2	S-A
Slabs to receive resilient flooring or carpet	S-1	S-A
Hydraulic channels	S-1	S-A
Underside of elevated slabs	S-3	S-A
Area 300 base slab	S-5	S-A
<b>Beams and Columns</b>		
Beams/coated	B-3	B-A
Beams/not coated	B-2	B-A
Columns/coated	C-3	C-A
Columns/not coated	C-2	C-A

**END OF SECTION**

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## SECTION 03302

### UNDERWATER CONCRETE

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies the requirements for concrete seal/buoyancy slab placed underwater in one continuous operation by means of tremie method.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	Specification for Structural Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C989	Standard Specification for Slag Cement for Use in Cement and Mortars
ASTM C1240	Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete

- B. Obtain services of an independent testing laboratory to perform required tests to document compliance with the Contract requirements.
- C. General Requirements: Section 03300 1.02C unless as modified in this Section.
- D. Comprehensive work plan of concrete production, placement, and quality controls shall include:
1. Concrete mixture proportions and the test data showing their compliance with the specification.
  2. Concrete delivery system and placement plan with detailed placement schedules and the system capacities. The validity of the systems shall be supported by the calculation of concrete placement rate and concrete delivery capacity. The systems shall be shown to meet the planned placement rate and continuous, uninterrupted operation until completion.
  3. Equipment for production, transportations, and placement of concrete. The method selected for transporting concrete shall ensure delivery without segregation, excessive delay, or excessive temperature change.
  4. Number and tremie pipe layout, and support of tremie pipes.
  5. Tremie concrete placement method, placement sequence, and placement rate.
  6. Relocation plan and procedure.

7. Number, method, equipment, and location of monitoring stations.
8. Laitance avoidance and removal.
9. The methods and equipment for sounding underwater concrete.
10. A contingency plan to deal with foreseeable incidents and breakdown, such as accidental discharge of concrete in water, blockage of the tremie pipe, relocation, and loss of seal. Include sample of log to record time and location of such incidents.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Plant, mix designer, testing agency, laboratory personnel qualifications; Thermal Control Plan; Alkali – Silica Reaction requirements; Trial mix design and batch mix reports; and Pre-installation conference for concrete placements: Section 03300.
- C. Concrete Mix designs signed by qualified mix designer. Include:
  1. Proportions by weight of all ingredients in mix.
  2. Solid volume calculations of all ingredients.
  3. Air content.
  4. Water-cementitious ratio.
  5. Slump flow in accordance with ASTM C1611.
  6. Trial mix cylinder compressive strengths at 3, 7, and 28 days in accordance with ACI 301.
- D. Product Data: Submit manufacturer's data on products showing quality and suitability for the application. Products are to be standards typically used in the industry for similar applications. Include:
  1. Portland cement.
  2. Admixtures.
  3. Fly ash.
  4. Ground granulated blast furnace slag.
  5. Aggregates.
  6. Admixtures: Manufacturers' Certificate of Proper Installation.
- E. Concrete delivery ticket for each batch of concrete before unloading at Site.
- F. Field test results:
  1. Slump flow for each 30 yards.
  2. Concrete unit weight for each 300 yards.
  3. Concrete test cylinders for each 1000 yards.
  4. Core sample at location and down to the depth of incidences.
- G. Field monitoring stations results:
  1. Rate of concrete placement.
  2. Depth of concrete at various locations and compared to sounding data.
  3. Volume of concrete produced compared to volume of concrete in place (measured by continuous recorded sounding).
  4. Concrete delivery system.
  5. Tremie pipe embedment depth.
  6. Incidences including:
    - a. Possible cold joint.
    - b. Delays in concrete placement.
    - c. Equipment malfunction.
    - d. Restarts.
    - e. Loss of tremie seal.
- H. Procedure for underwater concreting.



## **PART 2 PRODUCTS**

### **2.01 CONCRETE MATERIALS**

- A. Cement: ASTM C150, Type II.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Slag: ASTM C989, Grade 110 or Grade 120.
- D. Fly Ash: ASTM C618, Class F.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ASTM C1240.
- G. Water: Clean, free of silts, organics and other compounds detrimental to concrete.

### **2.02 ADMIXTURES**

- A. Air Entrainment Admixture: ASTM C260.
- B. Chemical Admixtures, as required: ASTM C494:
  - 1. Type A - Water Reducing.
  - 2. Type C – Accelerating.
  - 3. Type G - High Range Water Reducing.
  - 4. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- C. Acceptable Manufacturers:
  - 1. BASF Admixtures, Inc., Cleveland, OH; Pozzolith or Polyheed.
  - 2. Grace Construction Products, Cambridge, MA; WRDA with HYCOL.
  - 3. Euclid Chemical Co., Cleveland, OH; Eucon WR-91.
  - 4. Approved Equal.

### **2.03 CONCRETE MIX DESIGN**

- A. Proportioning Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Verify required average strength for each type of concrete on the basis of trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ an experienced independent testing agency acceptable to Project Representative for testing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Normal Weight Concrete:
  - 1. Compressive strength: 3000 psi minimum at 28 days, 4500 psi minimum at 56 days.
  - 2. Cement: 658 lbs to 752 lbs per cubic yard of concrete.
  - 3. Supplementary Cementitious Material
    - a. Slag Cement Content: 45 percent to 50 percent of cementitious materials by weight.
    - b. Fly Ash/Other Pozzolans: 45 percent to 50 percent of cementitious materials by weight.
    - c. Slag plus Pozzolan: 45 percent to 50 percent of cementitious materials by weight.
    - d. Pozzolan: 45 percent to 50 percent of cementitious materials by weight.

4. Water-Cement Material Ratio: Maximum 0.45 percent by weight.
5. Total Air Content: 6% +/- 1% percent, determined in accordance with ASTM C173.
6. Slump flow range: 12 inches to 22 inches.
7. Maximum Aggregate Size: 3/4 inches.
8. Fine Aggregate Range: 45% to 50% of total aggregates by weight.
9. Coarse Aggregate Range: 50% to 55% of total aggregates by weight.

## **2.04 MIXING**

- A. On Site: Mix in drum type batch mixer, complying with ASTM C685. Concrete mixing shall be in accordance with ACI 301.
- B. Transit Mixers: Comply with ASTM C494. Concrete mixing shall be in accordance with ACI 301.
- C. Frozen aggregates shall not be added to the concrete.
- D. When ice is used as part of mixing water, the ice shall be measured by mass and shall be completely melted by the time concrete mixing is completed.

## **2.05 OTHER MATERIALS**

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor. Submit product data to Project Representative.

## **PART 3 EXECUTION**

### **3.01 PLACING OF CONCRETE**

- A. Place all concrete in accordance with ACI 304R.
- B. All concrete underwater shall be tremie concrete and shall be placed by using the tremie method.
  1. The equipment for placing by the tremie method shall be as follows:
    - a. Be responsible for determining number, placement, and spacing of pipes. The tremie pipe shall be a straight vertical seamless rigid steel pipe of sufficient length to extend from the above the waterline to the bottom of the excavation. If pipe is jointed, the joints shall be waterproof. The pipe and funnel shall be supported so as to permit the discharge end to move freely across the entire work area and to drop rapidly to slow or stop the flow.
    - b. The pipe shall be rigid with, at least, 10 inches inside diameter and the upper end shall be equipped with a suitable funnel, hopper or receptacle, to receive the concrete.
    - c. The bottom end of the pipe shall include a device to seal out water, before admitting concrete at the commencement of each placement and on any withdrawal of the pipe.
    - d. A sounding lead shall be used to ascertain the level of the concrete in the excavation as the work proceeds.
  2. The method of placing the tremie concrete shall be as follows:
    - a. Concrete batching and transporting facilities shall be such as to ensure one continuous placement operation at a constant placement rate, while keeping the surface of the concrete nearly horizontal at all times.
    - b. The tremie pipe shall be positioned in an area of the excavation with the bottom seal in place.
    - c. Concrete shall be deposited to fill the pipe and then the pipe and funnel shall be carefully raised, but not out of the concrete at the bottom, to force out the plug and to allow the concrete to flow out by gravity.
    - d. Keep the water as still as possible. Move equipment slowly in the water so that cement erosion from the surface of the concrete will not occur.

- e. The bottom end of the pipe shall be kept continuously under the surface of the concrete throughout the placement and shall contain enough concrete to maintain tremie seal except only when the tremie pipe flow is stopped. Concrete shall not be disturbed after being deposited.
- f. Check that the water temperature is at least 50 °F where practical, but not less than 35 °F. Maximum initial concrete temperature shall not be more than 55 °F when truck arrives at the site.
- g. Placing operations shall proceed at the original point by gradually raising the pipe and hopper until the concrete surface is at the elevation indicated in the Drawing. Each increase in height shall be placed before the preceding concrete has taken its initial set. Restarting of tremie shall be by Dry Method only. Horizontal movement of embedded tremie pipe is not allowed.
- h. Maintain 1:3 to 1:12 range of tremie concrete surface slope.
- i. Tamping or internal vibration of concrete shall not be performed.
- j. Dewatering of the excavation shall not commence until the concrete has set sufficiently to withstand the hydrostatic pressure and, in no case, earlier than 5 days after placement of concrete.
- k. Remove all laitance accumulation on top of the seal placement after dewatering.

**END OF SECTION**

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## SECTION 03350

### POLISHED CONCRETE FLOOR FINISH

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
1. Grinding and polishing of interior concrete floor slabs (PC-01).
  2. Application of surface hardener.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
CPAA	Concrete Polishing Association of America

- B. Installer Qualifications. A firm that meets the following conditions:
1. Minimum 5 years experience with minimum 20 successful commercial quality concrete floor finishing projects comparable to work specified for this Project.
  2. Certified by liquid hardener manufacturer perform work of this Section, prior to Bid date.
- C. Pre-installation Conferences:
1. Concrete Slab Pre-Installation Conference:
    - a. Attend pre-installation conference as a part of concrete slab construction specified in Section 03300.
    - b. Discuss slab tolerances, finishing, curing, protection of surfaces, and all other items necessary to prepare the slab to receive polished concrete floor finish.
  2. Pre-Polishing Conference:
    - a. Attendance: Contractor, installer, Owner, Project Representative, polished concrete floor subcontractor, surface hardener manufacturer's representative, and other parties necessary to the Work of this Section.
    - b. Meeting Time: Prior to constructing mock-up.
    - c. Review condition of the slabs to be polished; slab tolerances, slab protection procedures, sequencing with other work, protection of adjacent construction, and mock-up area.
- D. Mock-ups:
1. Provide mock-ups in accordance with this Section.
  2. Provide minimum 8x8 foot mock-up of specified polished and densified concrete finish at an existing slab location as directed by the Project Representative. Select area which will subsequently be covered by other finishes in the completed Work or as selected by the Project Representative.
  3. Show typical joint treatment, surface finish, tolerances, and standard of workmanship.
  4. Approved mock-up may remain in the work, but cover with finished materials when accepted by the Project Representative.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.

- B. Product Data: For surface hardener systems.
- C. Quality Assurance Submittals:
  - 1. Installer Qualifications:
    - a. Verification the Installer is one of installers prior approved by the Project Representative.
    - b. Resume of installers which will be utilized to perform the on-site work. Verification that they are CPAA certified to meet the specified requirements.
  - 2. Contract Closeout Submittals:
    - a. Maintenance instructions in Operation and Maintenance Manual.

#### **1.04 PROJECT CONDITIONS**

- A. Certify that no fly ash has been added to slabs receiving polished concrete floor finish.
- B. Conform to manufacturer's instructions.
- C. Polished concrete shall be protected in accordance with the special concrete slab protection requirements specified in Section.

#### **1.05 SEQUENCING AND SCHEDULING**

- A. Application of surface hardener shall take place at least 10 days prior to any floor mounted furniture or equipment installation within the space.

#### **1.06 WARRANTY**

- A. Manufacturer: Standard 10 year Warranty that treated floor slab will remain water-repellant, dust proof, hardened, and abrasion-resistant.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS AND SYSTEMS**

- A. Surface Hardener Systems:
  - 1. Acceptable Products:
    - a. "RetroPlate 99" by Advanced Floor Products, Inc.; contact: Ron Ogden, RJ Ogden Associates, Inc.; Tel (425) 485-8373, cell (206) 498-4075.
    - b. "FGS Permashine" as manufactured by L & M Construction Chemicals, Inc.; contact Bill Pavitt, (425) 562-6076, cell (425) 785-3242.
    - c. "Liqui-Hard" densifier and chemical hardener with Bellatrix concrete enhancer by W.R. Meadows, Inc.
    - d. "Lythic Densifier - Concrete Floor Hardener" with "Lythic Protector Concrete Clear Sealer," by Lythic Solutions; (360) 964-5347.
    - e. Approved Equal.
  - 2. Description:
    - a. Abrasion Resistance: Up to 400 percent increase when tested in accordance with ASTM C779.
    - b. Impact Strength: Minimum 20 percent increase when tested in accordance with ASTM C805.
    - c. VOC Content: In accordance with the South Coast Air Quality Management District (SCAQMD) Rule 1113; Effective July 1, 2005 and rule amendment January 7, 2005.
- B. Accessories:
  - 1. Provide accessories required for complete installation and as approved by manufacturer.
  - 2. Neutralizing Agent: Tri-sodium phosphate or baking soda.
  - 3. Water: Clear and potable.

4. Cleaning Compounds: As recommended by surface hardener manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify surface free of chemicals, acids, curing compounds and other substances that may adversely affect installation.
- B. Verify the following:
  1. Fly ash was not used in concrete mix.
  2. Slab has been cured a minimum 28 days, or as instructed by the manufacturer, before beginning work of this Section.
  3. Concrete slab surfaces meet the tolerance requirements:
    - a.  $F_F$  40,  $F_L$  30 over test area;  $F_F$  35,  $F_L$  19, minimum local value.
- C. Vapor Testing of Concrete Substrate:
  1. Alkalinity:
    - a. Test Method: Measure pH according to method indicated in ASTM F 710.
    - b. Acceptable Results: pH between 8 and 10.
  2. Moisture Vapor Transmission Rate:
    - a. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
    - b. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.
  3. Relative Humidity:
    - a. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
    - b. Acceptable Results: Not more than 75 percent.

### **3.02 PREPARATION**

- A. Cover and protect surfaces not to receive surface hardener.
- B. Clean concrete surfaces to remove dirt, form oil, stains, oil, grease, adhesives, water repellants, compounds, and other substances that may deter penetration.

### **3.03 GRINDING AND POLISHING**

- A. Perform all polishing procedures to ensure a consistent appearance from wall to wall.
- B. Initial Grinding:
  1. Use grinding equipment with metal or semi-metal bonded tooling.
  2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
  3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
  4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
  5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
  6. Continue grinding until aggregate exposure matches approved field mock-ups.
- C. Treating Surface Imperfections:
  1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
  2. Fill surface imperfections including: holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.

3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.
- D. Surface Hardener Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer's instructions.
- E. Grout Grinding:
1. Use grinding equipment and appropriate grit and bond diamond tooling.
  2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
  3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- F. Honing:
1. Use grinding equipment with hybrid or resin bonded tooling.
  2. Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
  3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- G. Polishing:
1. Use polishing equipment with resin-bonded tooling.
  2. Begin polishing in one direction starting with 800 grit tooling.
  3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
  4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
  5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
  6. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness shall be less than .05 mils after cure.
  7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.
- H. Aggregate Exposure: Provide the following level of aggregate exposure in accordance with CCPA requirements.
1. Aggregate Exposure Class B – Fine / Sand Aggregate Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
- I. Gloss Level: Provide the following level of gloss in accordance with CCPA requirements.
1. Gloss Level 3 – Semi-Gloss Appearance:
    - a. Procedure: Not less than 4 steps with full refinement of each diamond tool with one application of densifier.
    - b. Gloss Measurement: Determine the specular gloss by incorporating the following:
      - 1) Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.
      - 2) Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.



### **3.04 FIELD QUALITY CONTROL**

- A. Manufacturer's Representative Services:
  - 1. Attend pre-installation meeting.
  - 2. Perform initial inspection and subsequent inspections during and at completion of work to verify conformance with manufacturer's instructions.
  - 3. Make recommendations for remedial action where non-conforming work is discovered.

### **3.05 CLEANING**

- A. Leave area clean, free from spillage, overspray, tracking, and other residue resulting from work of this Section.

### **3.06 PROTECTION**

- A. Protect concrete slabs to be stained and polished and exposed to view in the finished Work until Substantial Completion.
- B. Diaper or place secure drop cloths beneath equipment containing hydraulic fluids, crank case oil, brake fluid, or other similar petroleum based products.
- C. Do not use pipe cutting machines on the inside floor slab.
- D. Do not place steel directly on interior slabs to avoid rust staining.
- E. Do not allow acids and acidic detergents to come in contact with slab, to avoid staining and etching.
- F. Slab Covering:
  - 1. Place a breathable durable sheet product over the cured slabs to protect them from scratching, chipping, dirt migration, and other construction related damages.
  - 2. Tape seams in the covering. Do not tape the covering directly to the concrete slab.
  - 3. Repair and replace covering damaged by work operations. Maintain the continuity of the protective covering, including taped seams.
  - 4. Approved Products:
    - a. EZ Cover by McTech Group, Inc. [www.UltraCure.net](http://www.UltraCure.net).
    - b. RamBoard. [www.Ramboard.com](http://www.Ramboard.com).
  - 5. Place a hard breathable panel product such as plywood or OSB, over sheet covering at locations subject to heavy traffic, rolling loads, and overhead work, to protect from gouging and other surface damage. Connect panels with Simpson clips or other mechanical connectors to reduce warping and movement in panels.
- G. Inform all trades that slab shall be protected at all times.

### **3.07 ADJUSTING**

- A. Repair, replace, or make restitution for staining and overspray damage to surfaces damaged by work of this Section, as directed by Project Representative.
- B. Touch-up polished and surface hardened concrete prior to Substantial Completion of Project. Repair scratches, and other surface damage to show no evidence of repair.

**END OF SECTION**

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**SECTION 03370**  
**CONCRETE CURING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies the work associated with curing cast-in-place concrete.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing concrete
ASTM C1315	Standard Specification for Liquid Membrane-Forming Compounds having Special Properties for Curing and Sealing Concrete

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Curing methods proposed for each type of element such as slab, walls, beams, and columns in each facility.
- C. Manufacturers' data for the following products:
1. Evaporation retardant.
  2. Curing compound.
- D. Curing Compound: Manufacturer's Certificate of Compliance showing moisture retention requirements.
- E. MSDS for each product shall be maintained on site by the Contractor and copies submitted to the Project Representative for record.

**1.04 WARRANTY**

- A. For the Work of this Section, provide all warranties as described in the General Conditions 00700, Subsection 7.9B, and provide all normal commercial warranties available, as described in the General Conditions.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Curing Compound:
1. Water-based, high solids content nonyellowing curing compound meeting requirements of ASTM C309 and C1315.
    - a. Moisture Loss: 0.40 kg/square m/72 hours maximum.

- b. Capable of meeting moisture retention at manufacturer's specified application rate.
- 2. Manufacturers and Products:
  - a. BASF Building Systems, Inc., Shakopee, MN; Kure 1315.
  - b. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
  - c. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
  - d. Vexcon Chemical, Inc.; Philadelphia, PA; Starseal 1315.
  - e. Dayton Superior; Safe Cure and Seal 1315 EF.
  - f. Approved Equal.
- B. Evaporation Retardant:
  - 1. Optional: Fluorescent color tint that disappears completely upon drying.
  - 2. Manufacturers and Products:
    - a. BASF Building Systems; CONFILM.
    - b. Euclid Chemical Co., Cleveland, OH; Eucobar.
    - c. Approved Equal.
- C. Water: Clean and potable, containing less than 500 ppm of chlorides.

## **PART 3 EXECUTION**

### **3.01 CURING OF CONCRETE**

- A. Use one of the following methods as accepted by Project Representative:
  - 1. Walls:
    - a. General: Where walls are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures.
    - b. Method 1: Leave concrete forms in place and keep entire surfaces of forms and concrete wet for 7 days.
    - c. Method 2: Apply curing compound, where allowed, immediately after removal of forms.
    - d. Method 3: Continuously sprinkle with water 100 percent of exposed surfaces for 7 days starting immediately after removal of forms.
  - 2. Slabs and Curbs:
    - a. Method 1: Protect surface by water ponding for 7 days.
    - b. Method 2: Cover with burlap or cotton mats and keep continuously wet for 7 days.
    - c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 7 days.
    - d. Method 4: Continuously sprinkle exposed surface for 7 days.
    - e. Other agreed upon method that will keep moisture present and uniform at all times on surface of slabs. Do not use curing compounds.
    - f. Where water curing for slabs during cold weather is not possible, use a Project Representative-approved curing compound at manufacturer's recommended coverage per gallon.
    - g. Where curing compound cannot be used, special methods using moisture shall be agreed upon prior to placing the concrete slabs.
    - h. Protect slabs during cold weather with plastic sheets or other material inside required heated enclosure if foot traffic is permitted on slabs.
- B. Use only water curing on water-holding structures.
- C. Use only water curing where additional finishes such as clear sealer, hardeners, painting, and other special coatings are required.

### **3.02 EVAPORATION RETARDANT APPLICATION**

- A. Use on flatwork when environmental conditions are anticipated to cause rapid drying of the concrete surface.
- B. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture.
- C. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

### **3.03 MANUFACTURER'S SERVICES**

- A. Provide manufacturer's representative at Site.
- B. Provide curing compound manufacturer's representative to demonstrate proper application of curing compound to show coverage in one coat.
- C. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
- D. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.

**END OF SECTION**

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## SECTION 03600

### GROUT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies non shrink grout and epoxy grout for use in applications including, grouts for leveling machine bases to equipment pads, manhole masonry units, joints between precast concrete sections, filling toe holes, grouting blockouts for gate guides and grouting under base plates. Epoxy adhesives for concrete applications including, but not limited to pressure injection of cracks and doweling of anchor bolts, threaded rod anchors and reinforcing bar dowels.

##### 1.02 QUALITY CONTROL

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM C230	Standard Specification for Flow Table for Use in Tests of Hydraulic Cement
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
ASTM C289	Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRD-C621	US Army Corps of Engineers, Specification for Non-shrink Grout

B. Qualifications:

1. Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1-year experience that has resulted in successful installation of grouts similar to those for this Project.

2. For nonshrink grout suppliers not listed herein, provide completed 24-hour Evaluation of Nonshrink Grout Test Form, attached at the end of this Section. Independent testing laboratory to certify that testing was conducted within last 18 months. The costs for the laboratory tests associated with the 24-hour Evaluation of Nonshrink Grout Test shall be borne by the Contractor.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Manufacturer's Data for the following:
  1. Non-shrink cementitious grout.
  2. Epoxy grout.
  3. Admixtures for cement grout.
  4. Retardants.
  5. Bonding compounds.
  6. Certified Test Reports: Before delivery of materials or grout, submit certified reports of the tests specified herein. Accompany the certified reports on previously tested materials with the manufacturer's certified statement that the previously tested material is of the same type, quality, manufacture, and make as that proposed for use in this Contract. Certified test reports are required for the following:
    - a. All cement grout constituents, including cement and aggregates.
- C. Proposed method for keeping existing concrete surfaces wet prior to placing nonshrink grout.
- D. Forming method for fluid grout placements.
- E. Curing method for grouts.
- F. Manufacturer's Written Instructions:
  1. Cement-water ratio of grout topping.
  2. Mixing of grout.
- G. Manufacturer's proposed training schedule for grout work.
- H. Manufacturer's Certificate of Compliance:
  1. Grout free from chlorides and other corrosion-causing chemicals.
  2. Nonshrink grout properties of Category II, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
- I. Manufacturer's Certificate of Proper Installation.
- J. Statements of Qualification: Grout manufacturer's representative.
- K. Test Reports:
  1. Test report for 24-hour evaluation of nonshrink grout.
  2. Test results and service report from demonstration and training session.
  3. Field test reports and laboratory test results for field-drawn Samples.
- L. List of Contractor's equipment installation staff that has completed:
  1. Epoxy grout manufacturer's epoxy grout training.
  2. Nonshrink grout manufacturer's nonshrink grout training.
- M. Field Quality Control results.



## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver product in factory packages, clearly marked with manufacturer's identification, printed instructions, lot numbers, and shelf life expiration date on each component.
- B. Store materials at 65 to 85 degrees F (18 to 29 degrees C) in dry environment.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Grout mixes and admixtures shall not contain more than 0.05 percent chloride ions.
- B. Water for washing aggregate, for mixing and for curing:
  - 1. Shall be free from oil and deleterious amounts of acids, alkalis, and organic materials.
  - 2. Shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO<sub>4</sub>.
  - 3. Shall not contain any amount of impurities that may cause change of more than 25 percent in the setting time of the cement nor a reduction of more than five percent in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water.
  - 4. Water used for curing shall not contain any amount of impurities sufficient to discolor the grout.

### 2.02 GROUT SCHEDULE

- A. Furnish nonshrink grout and epoxy grout for applications in grout category in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 to 100 deg F	20 min	Greater than 20 min
Filling tie holes	I	I	I
Blockouts for gate guides	I or II		II
Wall mounted slide gates	I or II	I	II
Column baseplates single-story	I or II		II
Baseplates for columns over one story	II	II	II
Through-bolt openings	II	II	II
Machine bases	In accordance with Section 11050		
Baseplates and/or soleplates with vibration, thermal movement, etc.	In accordance with Section 11050		

### 2.03 MATERIALS

- A. Nonshrink Grout:
  - 1. Category I:
    - a. Nonmetallic and nongas-liberating.
    - b. Prepackaged natural aggregate grout requiring only the addition of water.
    - c. Test in accordance with ASTM C1107:
      - 1) Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230.
      - 2) Flowable for 15 minutes.
    - d. Grout shall not bleed at maximum allowed water.
    - e. Minimum compressive strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
    - f. Manufacturers and Products:
      - 1) BASF Building Systems, Inc., Shakopee, MN; Set Grout.
      - 2) Euclid Chemical Co., Cleveland, OH; NS Grout.
      - 3) Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.

- 4) US MIX Products, Denver, CO; US Spec Multi-Purpose Grout.
  - 5) L & M Construction Chemicals, Inc., Omaha, NE; Duragrout.
  - 6) Approved Equal.
2. Category II:
- a. Nonmetallic, nongas-liberating.
  - b. Prepackaged natural aggregate grout requiring only the addition of water.
  - c. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
    - 1) Test in accordance with COE CRD-C621 and ASTM C1107, Grade B.
    - 2) Fluid consistency 20 to 30 seconds in accordance with COE CRD-C611.
    - 3) Temperatures of 40, 80, and 100 degrees F.
  - d. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
  - e. Minimum compressive strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
  - f. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.
  - g. Manufacturers and Products:
    - 1) BASF Building Systems, Inc., Shakopee, MN; Master Flow 928.
    - 2) Five Star Products Inc., Fairfield, CT; Five Star 100.
    - 3) Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
    - 4) Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
    - 5) L & M Construction Chemicals, Inc., Omaha, NE; Crystex.
    - 6) Approved Equal.
- B. Epoxy Grout:
1. High strength, high temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.
  2. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.
  3. Premeasured, prepackaged system.
  4. Flowable.
  5. Minimum compressive strength in accordance with ASTM C579, Method B, 11,000 psi at 75 degrees F; 6,000 psi at 170 degrees F at 7 days.
  6. Maximum creep resistance in accordance with ASTM C1181 at 600 psi, 140 degrees F;  $6.0 \times 10^{-3}$  in/in.
  7. Minimum bond strength in accordance with ASTM C882, 2,000 psi.
  8. Minimum tensile strength in accordance with ASTM C307, 2,000 psi.
  9. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 to 210 degrees F,  $24.0 \times 10^{-6}$  in/in/°F.
  10. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.
  11. Good chemical resistance.
  12. Good effective bearing area.
  13. Noncorrosive.
  14. Moisture insensitive.
  15. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.
  16. Manufacturer and Product:
    - a. BASF Building System, Inc., Shakopee, MN; Masterflow 648 CP Plus.
    - b. Five Star Products, Inc., Fairfield, CT; DP Epoxy Grout.
    - c. Approved Equal.

## 2.04 FORMS

- A. Wood, metal, or plastic, of sufficient strength to withstand pressure from the liquid grout.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Mix, place and cure in accordance with the manufacturer's instructions.
- B. Form Tie or Through-Bolt Holes: Provide nonshrink grout, Category I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes, coordinate dry pack dense grout application with vinyl plug in Section 03100, and bonding agent in Section 03300.
- C. Grouting Column Baseplate: In accordance with Section 05120.
- D. Grouting Machinery Foundation: In accordance with Sections 11002 and 11050.

### **3.02 FIELD QUALITY CONTROL**

- A. An independent testing agency that complies with the requirements of ASTM E329 shall be retained by the Contractor and approved by the Project Representative. Be responsible, without additional cost to the County, for the cost of any additional tests and investigation on work performed which does not comply with the specifications. Supply all materials necessary for fabricating the test specimens.
- B. Evaluation and Acceptance of Nonshrink Grout:
  - 1. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
  - 2. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with COE CRD-C621.
  - 3. For large grout applications make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
  - 4. Consistency: As specified in this Section. Grout with consistencies outside range requirements shall be rejected.
  - 5. Segregation: As specified in this Section. Grout when aggregate separates shall be rejected.
  - 6. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
  - 7. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
  - 8. Perform bleeding test to demonstrate grout will not bleed.
  - 9. Store cubes at 70 degrees F.
  - 10. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with COE CRD-C621.
- C. Evaluation and Acceptance of Epoxy Grout:
  - 1. Performed by epoxy grout manufacturer's technical representative.
  - 2. Perform the following quality control inspections on the first installation of each size and type of equipment that is mounted using epoxy grout.
  - 3. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer's requirements.
  - 4. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria, including but not limited to substrate profile, degree of cleanliness, and moisture.
  - 5. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.
  - 6. Inspect the epoxy-primed metallic substrate for coverage and adhesion.
  - 7. Inspect preparation and application of epoxy grout form work for conformance to the specifications.
  - 8. Inspect and record that the "pot life" of epoxy grout materials is not exceeded during installation.

9. Inspect epoxy grout for cure.
10. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.
11. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.
12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.

D. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Project Representative to ensure continued compliance with these specifications. The specimens will be made by the Project Representative or its representative.
2. Compression tests and fabrication of specimens for nonshrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Project Representative. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Project Representative. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.
4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at no additional cost to the County.

### 3.03 MANUFACTURER'S SERVICES

A. General:

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative.
2. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of nonshrink grout.
3. Necessary equipment and materials shall be available for demonstration.
4. Notify Project Representative 3 days in advance of manufacturer's training so that site inspection staff may attend.

B. Nonshrink Grout Training:

1. Training is required for all Type II grout installations.
2. Grout manufacturer's representative shall train Contractor to perform grout work.
3. Establish location at Site and schedule time for grout manufacturer's demonstration and training session of proposed nonshrink grouts. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, e.g., baseplates and tie holes to provide actual on-the-job training.
4. Use minimum of five bags Category II. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1, 3, and 28 days. Use remaining grout for final Work.
5. Training shall include methods for curing grout.
6. Mix and demonstrate patching through-bolt holes, blockouts for gate guides, machinery base, and similar items.
7. Transport test cubes to independent test laboratory and obtain test reports.
8. Furnish a list of school attendees that have been satisfactorily trained to perform nonshrink grout installation.

C. Epoxy Grout Training:

1. Grout manufacturer's representative shall conduct epoxy grout installation training for Contractor's workers that will be installing epoxy grout for equipment mounts and the project representative's inspection staff.

2. Conduct training prior to equipment mount installation work on equipment pads.
3. Training shall be not less than 4 hours duration.
4. Cover all aspects of using the products, from mixing to application.
5. This requirement does not relieve Contractor of overall responsibility for this portion of the work.
6. Furnish a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

#### **3.04 SUPPLEMENTS**

- A. The supplement listed below, following "End of Section," is part of this Section.
  1. 24-hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.

**END OF SECTION**

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## SUPPLEMENT 1

\_\_\_\_\_  
(Test Lab Name)

\_\_\_\_\_  
(Address)

\_\_\_\_\_  
(Phone No.)

### 24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain five bags of each type of grout.

1. From intended grout supplier for Project.
2. Five bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

- |  |                  |
|--|------------------|
| A. Product data and warranty information contained in company literature and data?   | Yes_____ No_____ |
| B. Literature and bag information meet specified requirements?   | Yes_____ No_____ |
| C. Manufacturer guarantees grout as specified in this section?   | Yes_____ No_____ |
| D. Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas? | Yes_____ No_____ |
| E. Water demands and limits printed on bag?  | Yes_____ No_____ |
| F. Mixing information printed on the bag?  | Yes_____ No_____ |
| G. Temperature restrictions printed on bag?  | Yes_____ No_____ |

\*Rejection of a grout will occur if one or more answers are noted NO.

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## GROUT TESTING PROCEDURES

### A. Bagged Material:

1. List lot numbers. \_\_\_\_\_
2. List expiration date. \_\_\_\_\_
3. Weigh bags and record weight. \_\_\_\_\_

Project Representative will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

### B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10-gallon pail.
2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with COE CRD-C611 (flow cone) determine time of mixed grout through the flow cone. \_\_\_\_\_ seconds
6. Add water to attain 20 to 30 second flow in accordance with COE CRD-C611.
7. Record time of grout through cone at new water demand. \_\_\_\_\_ seconds
8. Record total water needed to attain 20 to 30 second flow. \_\_\_\_\_ pounds
9. Record percent of water. \_\_\_\_\_ percent

### C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, COE CRD-C621 will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

### D. Bleed Test:

1. Fill two-gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15-minute intervals for 2 hours.
6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

### E. Extended Flow Time and Segregation Test (for Category II):

1. Divide the remaining grout into two 3 gallon cans. Place the cans into the 40-degree F and 100-degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4-inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.

2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take a COE CRD-C611 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 and 100 degrees F.
  - a. 20 min \_\_\_\_\_, sec. @ 40 degrees F.
  - b. 40 min \_\_\_\_\_, sec. @ 40 degrees F.
  - c. 60 min \_\_\_\_\_, sec. @ 40 degrees F.
  - d. 20 min \_\_\_\_\_, sec. @ 100 degrees F.
  - e. 40 min \_\_\_\_\_, sec. @ 100 degrees F.
  - f. 60 min \_\_\_\_\_, sec. @ 100 degrees F.

All Category II grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

\_\_\_\_\_  
Qualified

\_\_\_\_\_  
Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with COE CRD-C621 for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.
2. Store cubes at 70 degrees F for 24 hours.
3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are under 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

\_\_\_\_\_  
Signature of Independent Testing Laboratory

\_\_\_\_\_  
Date Test Conducted

## SECTION 03720

### VERTICAL AND OVERHEAD CONCRETE SURFACE REPAIR SYSTEMS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies vertical and overhead concrete surface repair systems to repair structural and non-structural defects in old or in new construction.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revisions of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AASHTO T277	Standard Method of Test for Rapid Determination of the Chloride Permeability of Concrete
ACI 506R	Guide to Shotcrete
ASTM A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C157	Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete
ASTM C348	Standard Test Method for Flexural Strength of Hydraulic Cement Mortars
ASTM C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C596	Standard Test Method for Drying Shrinkage of Mortar Containing Portland Cement
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C1202	Standard Test Method for Electrical Induction of Concrete's Ability to Resist Chloride Ion Penetration
ASTM E699	Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee

B. Qualifications:

1. Independent testing laboratory: Based on evaluation of laboratory submitted criteria in accordance with ASTM E699.
2. Mortar system applicator: Experienced shotcrete applicator endorsed by mortar system manufacturer. For low pressure spray mortar system in lieu of endorsement, complete mortar system manufacturer's demonstration as specified in this Section.

3. Mortar system manufacturer's representative:
    - a. Capable of instructing successful methods for repairing vertical and overhead concrete surfaces.
    - b. Understands and is capable of explaining technical aspects of correct material selection and use.
  4. Shotcrete nozzleman: ACI certification in accordance with ACI 506R.
- C. Mockups: For each type of mortar system application demonstration, prepare an area of at least 10 feet by 10 feet by the average thickness required for the Project.
- A. Pre-repair Conference:
1. Required Meeting Attendees:
    - a. Contractor.
    - b. Repair Subcontractor.
    - c. Technical representative for repair material manufacturer.
    - d. Project Representative.
  2. Schedule and conduct prior to conducting mockups and incorporation of respective products into Project. Notify Project Representative of location and time.
  3. Agenda shall include, but not limited to:
    - a. Review of field conditions. Conduct field observations of Work to be performed.
    - b. Based on above observations, repair material manufacturer's technical representative shall confirm material selection and make Project-specific repair method recommendations.
    - c. Technical representative for repair material manufacturer shall review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
    - d. Other specified requirements requiring coordination.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Samples: Mesh reinforcement and mesh anchor.
- C. Mortar system:
  1. Manufacturer's installation bulletin.
  2. Manufacturer's recommended fabric size for mesh reinforcement.
  3. Product data sheet for each material.
- D. Mesh manufacturer's installation instructions and allowable load criteria.
- E. Written description of equipment proposed for hydrodemolition surface preparation.
- F. Certificates:
  1. Certificate of Compliance that proposed product systems meet or exceed specified performance criteria when tested as specified within this Section.
  2. Mortar system Manufacturer's Certificate of Proper Installation.
- G. Statements of qualification:
  1. Independent testing laboratory.
  2. Shotcrete Nozzleman.
  3. Mortar system manufacturer's representative.
- H. Mortar system manufacturer's proposed modified test procedures for ASTM C109 and ASTM C882 test methods.

- I. Independent testing laboratory test report of all laboratory and field testing.

## **1.04 DEFINITIONS**

- A. Low pressure spray mortar: Mortar designated by "S" before the product number, applied by low pressure spraying, or in small areas by hand troweling.
- B. Nonstructural: Areas that are deemed by the Project Representative to be "surface" only, and not under structural load or heavy wear requirements; less than 1 inch in depth.
- C. Rebound: Wet shotcrete that bounces off a surface against which it is projected.
- D. Shotcrete: Mortar pumped through a hose and projected at high velocity.
- E. Structural: Areas that are subject to structural loading or heavy wear, and are defects or parts of defects that extend 1 inch or deeper into the concrete.

## **PART 2 PRODUCTS**

### **2.01 SHOTCRETE MORTAR SYSTEM (STRUCTURAL)**

- A. Properties of mixed mortar:
  - 1. Working Time: 5 to 10 minutes.
  - 2. Finishing Time: 10 to 20 minutes.
  - 3. Color: Dark gray.
- B. Properties of cured mortar:
  - 1. Compressive strength for 2-inch cubes and in accordance with ASTM C109 or 3-inch cubes in accordance with "modified" ASTM C109:
    - a. 2 Days: 5,100 psi minimum.
    - b. 7 Days: 6,000 psi minimum.
    - c. 28 Days: 7,000 psi minimum.
  - 2. Flexural strength (modulus of rupture), ASTM C78 at 28 days: 1,100 psi minimum.
  - 3. Tensile strength, ASTM C496 at 28 Days: 400 psi minimum.
  - 4. Rapid chloride permeability, ASTM C1202 or AASHTO T277: 800 coulombs maximum.
  - 5. Mortar shall not produce a vapor barrier.
- C. Mortar materials:
  - 1. Blend of selected Portland cements, microsilica, and specially graded aggregates and fibers applicable for vertical and overhead surfaces.
  - 2. Materials shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements.
  - 3. Noncombustible before and after cure.
  - 4. Furnish in a factory-proportioned unit.
  - 5. Workability from 1/4-inch depth and greater.
- D. Manufacturers and products for shotcrete mortar system:
  - 1. Sika Corp., Lyndhurst, NJ; SIKACEM 103 with fibers added in accordance with manufacturer's recommendations.
  - 2. BASF Building Systems, Shakopee, MN; MBT P&R Shotpatch 21F.
  - 3. Euclid Chemical Co., Cleveland, OH; Euco shot with Tuf-Strand SF added per manufacturer's recommendations.
  - 4. Approved Equal.

### **2.02 LOW PRESSURE SPRAY MORTAR SYSTEM (STRUCTURAL)**

- A. Mortar:
  - 1. One component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.
  - 2. Cured materials mixed to a flow of 70 percent, at five drops shall conform to the following criteria:
    - a. Minimum Slant Shear Bond Strength: 3,000 psi in 28 days in accordance with ASTM C882 test method, modified with no bonding agent.
    - b. Minimum Compressive Strength: 6,000 psi at 28 days in accordance with ASTM C109.
    - c. Minimum Tensile Bond Strength ACI 503R, Appendix A, or ASTM C496: 300 psi. in 28 days.
    - d. Minimum Flexural Properties: 1,100 psi in 28 days in accordance with ASTM C348.
    - e. Rapid Chloride Permeability: 800 coulombs in accordance with ASTM C1202 or AASHTO T277.
    - f. Drying Shrinkage at 28 Days: 0.1 percent maximum in accordance with ASTM C157 Modified.
    - g. System shall not produce a vapor barrier.
- B. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water.
- C. Free of chlorides and other chemicals causing corrosion.
- D. Manufacturers and products:
  - 1. BASF Building Systems, Shakopee, MN; MBT P&R EMACO S88CI for hand applied areas.
  - 2. Sika Corp., Lyndhurst, NJ; Sika Repair 224.
  - 3. Approved Equal.

### **2.03 POLYMER-MODIFIED REPAIR MORTAR (NON-STRUCTURAL)**

- A. Polymer-modified, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar conforming to the following properties:
  - 1. Minimum Slant Shear Bond Strength: 2,000 psi in 28 days in accordance with ASTM C882 test method modified with no bonding agent.
  - 2. Compressive strength, ASTM C109 at 28 days: Minimum 7,000 psi.
  - 3. Flexural properties, ASTM C348 at 28 days: Minimum 1,200 psi.
  - 4. Rapid chloride permeability, ASTM C1202 or AASHTO T277: 800 coulombs maximum.
  - 5. Splitting tensile strength. ASTM C496 at 28 days: 500 psi minimum.
  - 6. Drying shrinkage, ASTM C596 at 28 days: Maximum 0.12 percent.
  - 7. Freeze thaw resistance, ASTM C666, at 300 cycles: 90 percent RDF.
- B. Manufacturers and products:
  - 1. BASF Building Systems, Shakopee, MN; MBT P&R: EMACO R300 CI and R-320 CL.
  - 2. Sika Corp., Lyndhurst, NJ; Sika Top 123 Plus.
  - 3. Approved Equal.

### **2.04 WATER**

- A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

### **2.05 ACCESSORIES**

- A. Mesh reinforcement: Welded wire fabric with spacing of wires, and wire size in accordance with ASTM A185 and ASTM A82, and mortar system manufacturer's recommendations.
- B. Tie wire: 16 gauge galvanized.

- C. Mesh anchors:
  - 1. Stainless steel Type 304 tie wire anchors.
  - 2. Manufacturers and products:
    - a. Hilti, Inc.; Kwik Bolt II HHDA.
    - b. Powers Fastening, Inc.; Tie Wire Version of Power-Stud.
    - c. UCAN Fastening Products; UCAN Tie Wire Wedge Anchor.
    - d. Approved Equal.
- D. Finishing aid manufacturers and products:
  - 1. BASF Building Systems, Shakopee, MN; MBT P&R CONFILM.
  - 2. Euclid Chemical Co., Cleveland, OH; Eucobar.
  - 3. Sika Corp., Lyndhurst, NJ; Sikafilm.
  - 4. Approved Equal.
- E. Flexible cementitious rebar coating manufacturers and products:
  - 1. BASF Building Systems, Shakopee, MN; MBT P&R EMACO P22.
  - 2. Sika Corp., Lyndhurst, NJ; Armatec 110.
  - 3. Approved Equal.

## **2.06 BONDING AGENT**

- A. Epoxy resin and concrete cement adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.
- B. Mixed bonding agent properties:
  - 1. Pot Life: 75 to 105 minutes.
  - 2. Contact Time: 24 hours.
  - 3. Concrete Color: Gray.
- C. Cured epoxy resin portland cement adhesive properties:
  - 1. Splitting tensile strength, ASTM C496 at 28 days: 500 psi minimum.
  - 2. Flexural strength, ASTM C348: 1,000 psi minimum.
  - 3. Bond strength, ASTM C882 at 14 days:
    - a. 0 Hour open time: 2,500 psi minimum.
    - b. 24 Hours open time: 2,000 psi minimum.
  - 4. Bonding agent shall not produce a vapor barrier.
  - 5. Compatible with mortar system.
- D. Manufacturers and products:
  - 1. Sika Corp., Lyndhurst, NJ; Sika Armatec 110.
  - 2. BASF Building Systems, Inc., Shakopee, MN; MBT P&R EMACO P24.
  - 3. Approved Equal.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Where required because of deficiencies, concrete surface repair system may either be shotcrete mortar or low pressure spray mortar for structural repairs and hand or low pressure spray applied polymer-modified mortar for non-structural surface applications.
- B. The color of the polymer-modified repair mortar shall be adjusted to match background wall surface where the wall finish is to be exposed and not painted.

### **3.02 PREPARATION**

- A. Remove unsound and deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16-inch or as shown. Remove to provide for maximum thickness specified for mortar.
- B. High pressure water blasting machines with 16,000 to 20,000-psi minimum.
- C. To avoid tapered shoulders square edges of patch areas by sawing or chipping.
- D. Collect and dispose of water from removal operations in manner and location acceptable to Project Representative.
- E. Do not use power-driven jackhammers and chipping hammers, unless water blasting is prohibited due to potential damage to installed equipment.
- F. Remove concrete minimum of 1-inch clearance around rebar for application and bonding of new mortar to entire periphery of exposed rebar if the following surface conditions exist:
  - 1. 50 percent or more of periphery around rebar is exposed during removal of concrete.
  - 2. 25 percent or more of periphery around rebar is exposed during removal of concrete and corrosion has eventuated to the extent that loss of section has occurred.
  - 3. Bond between existing concrete and reinforcement has deteriorated.
- G. Clean exposed reinforcing bars of rust and concrete, and coat with flexible cementitious rebar coating.
- H. Maintain surface areas free of slurry where concrete has been removed. Remove slurry from prepared areas before new mortar is applied.
- I. Clean surface areas to be filled with new mortar of laitance and contamination by high-pressure water blasting not more than 24 hours before applying bonding agent. Saturated surface dry (SSD) existing concrete at time of application of mortar.

### **3.03 INSTALLATION OF MESH REINFORCEMENT**

- A. Provide reinforcement when mortar application is more than 3 inches deep unless otherwise shown and when existing reinforcement is not exposed.
- B. Install mesh anchors in accordance with mesh manufacturer's instructions.
- C. Fasten reinforcement to mesh anchors with tie wire.
- D. Lap reinforcement a minimum of one mesh spacing and secure with tie wire at intervals no less than 12 inches.

### **3.04 SHOTCRETE MORTAR APPLICATION**

- A. Apply mortar in accordance with manufacturer's instructions.
- B. Do not reuse rebound materials.
- C. Apply mortar utilizing dry mix process.
- D. Mortar shall emerge from nozzle in a steady, uninterrupted flow. If flow becomes intermittent, direct flow away from Work until flow of mortar becomes constant.



- E. Minimum thickness of applied mortar 1-1/2 inches, or 2 inches of cover over existing reinforcement which ever results in a thicker coat.
- F. Slice off excess material with a wire screed approximately 5 to 10 minutes after initial set.
- G. Apply finish to exposed mortar surfaces to match existing surfaces and in accordance with manufacturer's instructions. Steel trowel finish when finish coat is not applied. Apply finishing aid full strength.
- H. Rebound removal: Continuously throughout mortar application, remove rebound, sand, and miscellaneous debris. Do not work rebound in under fresh mortar.
- I. Nozzle position: Hold nozzle approximately at right angles to and at a distance from surfaces in accordance with mortar system manufacturer's instructions for type of, application, nozzle, and air pressures used.
- J. Reinforcing steel encasement: Modify procedure of shooting mortar to better direct material around reinforcement bars. Prevent mortar from building up on reinforcement steel when shooting on, around, through, and behind steel to eliminate voids. Provide dense void-free encasement of reinforcement steel.
- K. Shotcreting more than one layer: In accordance with mortar system manufacturer's instructions.

### **3.05 LOW PRESSURE SPRAY MORTAR APPLICATION**

- A. Mix mortar in mortar-concrete mixer attached to pump-spray equipment for spray application. Mix with a slow speed drill and jiffler type paddle or small mortar type mixer for hand trowel application.
- B. After priming substrate per manufacturer's recommendations, apply mortar by low pressure spraying with a machine such as Moynotype, MEYCO DEQUANA, Model 20, or Approved Equal.
- C. Finish mortar with a hand float application to smooth even surface matching adjacent concrete. Provide finishing aid at full strength.
- D. Bonding agent:
  - 1. Hand apply bonding agent within 20 minutes of troweling on mortar. Prevent bonding agent from drying by reapplying bonding agent to maintain surface tackiness of coat.
  - 2. Work mortar firmly and quickly into area and compact with firm trowel stroke. Finish smooth with finishing aid at full strength.

### **3.06 POLYMER-MODIFIED REPAIR MORTAR APPLICATION (NONSTRUCTURAL)**

- A. Mix mortar in mortar-concrete mixer attached to pump-spray equipment for spray application. Mix with a slow speed drill and jiffler type paddle or small mortar type mixer for hand trowel application.
- B. Hand troweling: Apply a bond coat slurry of the repair mortar to the SSD prepared substrate before application of the mortar. Do not apply more of the bond coat than can be covered with mortar before the bond coat dries. Do not retemper this bond coat.
- C. Place mortar by hand or low pressure spray and trowel to the specified surface finish.

### **3.07 CURING**

- A. Water fog nozzle all of the mortar systems prior to curing in accordance with mortar system manufacturer's instructions.

- B. Commence water curing after mortar system application and when curing will not cause erosion of mortar.
- C. Continuously cure mortar system for a period of 7 days.
- D. Do not membrane cure unless method is part of mortar system manufacturer's instructions, and approval is obtained.
- E. Cure intermediate layers of mortar in accordance with manufacturer's instructions.

### **3.08 FIELD QUALITY CONTROL**

- A. Independent testing laboratory shall be retained by the Contractor and approved by the Project Representative, and shall perform the following:
  - 1. Secure production samples of mixed materials during construction and test for compliance with the Specifications.
  - 2. Obtain actual core samples from the completed repair Work and test.
  - 3. Perform "modified" ASTM C109 and ASTM C882 test methods in accordance with manufacturer's approved modifications of testing procedures.
- B. Construction testing:
  - 1. Production samples:
    - a. Obtain mixed mortar material from shotcrete or spray equipment and produce samples, and cure samples prior to testing.
    - b. Provide minimum of three samples each test for each 1,000 square feet or portion thereof of mortar repair to be installed.
  - 2. Core samples of in-place repair:
    - a. Obtain two core samples and test samples for each 2,000 square feet or portion thereof for actual repair Work.
    - b. Cores shall be either 2-1/2 inches or 3 inches in diameter and shall be cored through cured mortar repair and into base concrete to total depth equal to at least 2.5 times repair mortar thickness.
    - c. Sawcut the cores after removal to trim base concrete thickness to same thickness as mortar so that bond line is at center of repaired sample.
    - d. Samples shall be epoxy bonded to steel plates at each end using a bonding agent to prevent failure in bond to steel plates.
    - e. Sustain bond line without failure or movement with a minimum of 300 psi in direct tension. The tension test shall use eyebolts or threaded connectors tapped and threaded into baseplate so that tension load is concentric with center of core sample.
- C. Repair and fill holes where core samples have been removed using same mortar used in repair.

### **3.09 MANUFACTURER'S SERVICES**

- A. Provide mortar system manufacturer's representative at Site for installation assistance, inspection and certification of proper installation, and training of mortar system applicators.
- B. Mortar system manufacturer's demonstration:
  - 1. Schedule a time for manufacturer's demonstration of repair system proposed for the Project. Prepare mortar, to specified consistency, for testing and placement. Initiate curing on portions of each type of surface to be repaired to include overhead and vertical applications.
  - 2. Prepare surface area in advance of demonstration and obtain manufacturer's acceptance of preparation for each type of application.
  - 3. Demonstrate:
    - a. Mixing and application equipment capabilities and procedures, including the flow of material from nozzle or sprayer.

- b. Nozzle operator and person in charge of low-pressure sprayer, capabilities and ability to follow prescribed application procedures and properly operate equipment and apply surface repair materials.
- 4. Make compression test samples during demonstration and deliver to an independent testing laboratory for testing at 1, 7, and 28 days. Take a core of the demonstration placement and test for tensile bond at 1 day.

### **3.10 PROTECTION**

- A. Protect adjacent surfaces, and equipment, from being damaged by overshooting shotcrete mortar and low pressure spray mortar.

### **3.11 CLEANING**

- A. Remove overshot mortar and deposited rebound materials as Work proceeds. Remove from Work, waste materials, unsound material from concrete surfaces, material chipped from walls, water used in preparation of application and finishing.

**END OF SECTION**

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## SECTION 03722

### HORIZONTAL CONCRETE SURFACE REPAIR SYSTEMS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies surface repair systems to repair horizontal defects in concrete.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
40 CFR 52.254	Federal Air Quality Regulation
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C348	Standard Test Method for Flexural Strength of Hydraulic Cement Mortars
ASTM C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C596	Standard Test Method of Drying Shrinkage of Mortar Containing Portland Cement
ASTM C779	Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
ASTM C1042	Standard Test Method for Bond Strength of Latex Systems Used with Concrete by Slant Shear
ASTM C1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetrations
ASTM E699	Standard Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6

- B. Qualifications:
1. Independent Testing Laboratory: Meet criteria stated in ASTM E699.
  2. Mortar System Applicator: Trained and approved by mortar system manufacturer.
  3. Mortar System Manufacturer's representative:
    - a. Capable of instructing successful methods for repairing horizontal concrete surfaces.
    - b. Understands and is capable of explaining technical aspects of correct material selection and use.
- C. Pre-repair Conference:
1. Required Meeting Attendees:
    - a. Contractor.
    - b. Repair Subcontractor.
    - c. Technical representative for repair material manufacturer.
    - d. Project Representative.
  2. Schedule and conduct prior to conducting mockups and incorporation of respective products into Project. Notify Project Representative of location and time.
  3. Agenda shall include, but not limited to:
    - a. Review of field conditions. Conduct field observations of Work to be performed.

- b. Based on above observations, repair material manufacturer's technical representative shall confirm material selection and make Project-specific repair method recommendations.
- c. Technical representative for repair material manufacturer shall review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
- d. Other specified requirements requiring coordination.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Mortar system manufacturer's test and product data.
- C. Mortar System Manufacturer's:
  - 1. Certificate of Compliance that repair products are one component with added water only, shrinkage compensated, specially designed for use on horizontal surfaces that are weather exposed, and receive traffic.
  - 2. Manufacturer's Certificate of Proper Installation.
  - 3. Recommended preparation and installation instructions.
- D. Independent testing laboratory test report for each production and core Sample.
- E. Statements of Qualification:
  - 1. Independent Testing Laboratory.
  - 2. Mortar System Applicator.
  - 3. Manufacturers Site Representative.

### **1.04 PACKAGING**

- A. Package mortar system products in 55-pound moisture-resistance bags, 50-pound pails, or 3,300-pound bulk bags.

## **PART 2 PRODUCTS**

### **2.01 MORTAR SYSTEM**

- A. One-Component, Fast-Setting, Polymer Modified Cementitious Based Mortar System:
  - 1. Bond Strength: ASTM C1042, 7 days, 1,750 psi.
  - 2. Flexural Strength: ASTM C348, 7 days, 1,000 psi.
  - 3. Abrasion Resistance: ASTM C779, 60 minutes, 0.0165 inch.
  - 4. Splitting Tensile Strength: ASTM C496, 7 days, 450 psi.
  - 5. Drying Shrinkage: ASTM C596, 28 days, 0.093 percent.
  - 6. Rapid Chloride Permeability: ASTM C1202, 28 days under 500 coulombs.
  - 7. Compressive Strength: ASTM C109, 1 day, 2,500 psi; 7 days, 5,500 psi; 28 days, 7,500 psi minimum.
- B. Manufacturer and Product:
  - 1. BASF Building Systems; EMACO R310.
  - 2. Sika Corp: Sika Repair 224.
  - 3. Approved Equal.

## **2.02 ACCESSORY MATERIALS**

- A. Flexible Cementitious Reinforcing Bar Coating: BASF Building Systems, Inc., Shakopee, MN; EMACO P22; or Approved Equal.
- B. Epoxy Bonding Agent: BASF Building Systems; Concrese LPL liquid; or Approved Equal.
- C. Finishing Aid:
  - 1. Containing a yellow fugitive dye.
  - 2. Manufacturer and Product: BASF Building Systems; CONFILM; or Approved Equal.
- D. Membrane Forming Curing Compounds: BASF Building Systems; MASTERKURE 200W; or Approved Equal.

## **2.03 MIXING**

- A. In accordance with mortar manufacturer's instructions.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Where required because of deficiency in new concrete provide:
  - 1. Patches and overlays 1/4 inch up to 3 inches thick.
  - 2. Return to service for foot traffic in 4 hours; wheel traffic in 7 days.
  - 3. Working time 30 minutes at 70 degrees F (21 degrees C).
  - 4. Application temperature range from 45 degrees F to 90 degrees F.

### **3.02 PREPARATION**

- A. General:
  - 1. For patch areas 1/4 inch or deeper, follow the International Association of Concrete Repair Specialists, Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Oxidation.
  - 2. Remove unsound and deteriorated concrete by special 16,000 to 20,000 psi high chisel pointed - jack hammer or pressure water blasting machines capable of removing concrete to depths of 3/16-inch minimum amplitude roughness when measured with a straightedge.
  - 3. Square edges of patch areas by sawing or chipping to avoid tapered shoulders.
  - 4. Collect and dispose of water from removal operations in manner and location acceptable to Project Representative.
  - 5. Remove concrete adjacent to reinforcing bar to a minimum of 1-inch clearance around reinforcing bar to permit new mortar to bond to entire periphery of exposed reinforcing bar if following surface conditions exist:
    - a. 50 percent or more of periphery around reinforcing bar is exposed during concrete removal.
    - b. 25 percent or more of periphery around reinforcing bar is exposed during concrete removal and corrosion is present to extent that loss of section has occurred.
    - c. Otherwise evident that bond between existing concrete and reinforcement has been destroyed.
  - 6. Clean exposed reinforcing bars of rust and concrete.
  - 7. Replace deteriorated reinforcing with new reinforcing equivalent in cross-sectional area to original reinforcing.
  - 8. Coat exposed reinforcing bar with flexible cementitious reinforcing bar coating before repair mortar is applied.
  - 9. Keep areas from which concrete has been removed free of dirt, dust, and water blasting slurry. Remove contaminants from prepared areas before new mortar is placed.

10. Areas to receive mortar shall be saturated and surface dry at time of application.

**B. Spalled Joints:**

1. Saw edge 1 inch deep and 6 inches back from the old joint.
2. Remove unsound concrete between saw cut and the joint.
3. Place wood or fiber spacer to thickness of joint at joint line.

**C. Overlays:**

1. Square cut edges to a minimum of 1/4-inch depth.
2. Do not feather edge area.
3. Perform special preparation recommended by mortar manufacturer.

### **3.03 BONDING**

- A. Provide a slurry coat of in accordance with manufacturer's instructions.

### **3.04 INSTALLATION**

- A. Remove standing water.
- B. Apply bond coat slurry to prepared surface.
- C. Immediately place mixed repair mortar into prepared area from one side to the other.
- D. Work material firmly into bottom and sides of patch to assure a good bond.
- E. Level repair mortar and screed to elevation of existing concrete.
- F. Finish to same texture as existing concrete around patch.
- G. Screed or use self-leveling mixture to obtain a uniform and plane surface.
- H. Joint Repair:
1. Remove joint spacer when repair mortar is hard enough that a pointed trowel will only penetrate surface less than 1/2 inch.
  2. When repair mortar is cured and ready for use, fill joint in accordance with mortar system manufacturer's instructions.
- I. At locations to receive polished concrete floor finish, coordinate repairs with polished concrete subcontractor and manufacturer recommendations.

### **3.05 FINISHING**

- A. Spray full strength finishing aid on fresh concrete to prevent rapid drying during hot and windy weather.

### **3.06 CURING**

- A. Provide water-based wax emulsion in accordance with moisture retention requirements of ASTM C309, Type 1 when applied at 250 square feet per gallon. Apply in compliance with Federal Air Quality Regulation 40 CFR 52.254.
- B. Apply membrane forming curing compound at no more than 250 square feet per gallon, as soon as finishing operation is complete.



- C. Apply second coat of curing compound at no more than 250 square feet per gallon, after 3 hours, or when first coat is not tacky to the touch.

### **3.07 MANUFACTURERS' SERVICES**

- A. Provide mortar manufacturer's representative at Site for advice on product selection, surface preparation, mixing and installation assistance, and inspection and certification of proper installation.

### **3.08 FIELD QUALITY CONTROL**

- A. Independent testing laboratory shall be retained by the Contractor and approved by the Project Representative, and shall perform the following:
  - 1. Production Samples:
    - a. Prepare and cure Samples of mixed mortar material from mixer.
    - b. Provide minimum of three compressive Samples per ASTM C109 for each test specified for each 200 square feet of mortar repair.
  - 2. Chain drag or light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to the old concrete:
    - a. Mark hollow areas for removal and replacement.
    - b. Saw hollow sounding areas to a new square edge, and reapply mortar as specified.
  - 3. Core Samples:
    - a. Core two 2-1/2- or 3-inch diameter Samples for each 2,000 square feet of repair work.
    - b. Cut cores through cured mortar repair and into base concrete to total depth equal to at least 2.5 times the repair mortar thickness.
    - c. Sawcut cores after removal to trim base concrete thickness to same thickness as mortar so bond line is at center of prepared Sample.
    - d. Bond samples to steel plates at each end using epoxy-bonding agent.
    - e. Perform tension testing using calibrated independent test laboratory equipment and eyebolts or threaded connectors tapped and threaded into the baseplate so that the tension load is concentric with the center of the core Sample.
    - f. Bond line shall sustain minimum of 300 psi in direct tension without failure or movement.
  - 4. Retest mortar repairs that do not meet test requirements.
  - 5. Fill and repair test holes as specified herein.

**END OF SECTION**

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## SECTION 03740

### CONCRETE REPAIR CRACK INJECTION

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies the materials, testing, and workmanship necessary to structurally repair cracks in concrete structures.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AASHTO T237	Standard Method for Testing Epoxy Resin Adhesive
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D648	Standard Test Method for Deflection of Plastics Under Flexural Load
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM E699	Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

- B. Qualifications for epoxy injection staff:
1. Manufacturer's site representative:
    - a. Capable of instructing successful methods for restoring concrete structures utilizing epoxy injection process.
    - b. Understands and is capable of explaining technical aspects of correct material selection and use.
    - c. Experienced in the operation, maintenance, and troubleshooting of application equipment.
  2. Injection crew and job foreman shall provide written and verifiable evidence showing compliance with the following requirements:
    - a. Licensed and certified by epoxy manufacturer.
    - b. Minimum 3 years' experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection including 2,000 linear feet of wet crack injection to stop water leakage.
- C. Qualifications of Independent Testing Laboratory: Meet criteria stated in ASTM E699.
- D. Injected cracks and joints which leak shall be considered deficient work irrespective of depth of penetration. Reinjection of deficient work or, with approval of Project Representative, provide other repairs to eliminate leakage.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Physical and chemical properties for epoxy adhesives.
- C. Technical data for metering, mixing, and injection equipment.

- D. Manufacturer's recommended surface preparation procedures and application instructions for epoxy adhesives.
- E. Installation instructions for repairing core holes with epoxy grout.
- F. Marked up drawings of proposed epoxy injection repair crack locations, widths, and lengths and direction on structure.
- G. Manufacturer's Certificate of Compliance: Certified test results for each batch of epoxy adhesive.
- H. Statements of qualification for epoxy adhesive:
  - 1. Manufacturer's Site representative.
  - 2. Injection applicator.
  - 3. Injection pump operating technician.
- I. Epoxy adhesive two component ratio and injection pressure test records for concrete crack repair work.
- J. Independent testing laboratory test reports for quality control test and field tests.

#### **1.04 DEFINITIONS**

- A. Large cracks: Wider than 0.015 inch.
- B. Small cracks: Width equal to 0.015 inch or less.
- C. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.
- D. Joint: A planned and formed discontinuity in concrete structure at junction of adjacent and sequential concrete placements and may contain embedded waterstops.
- E. Leak or Leakage: Crack or joint exhibiting presence of moisture, sign of efflorescence, intermittently wet to touch, or continuous flow of liquid.
- F. Injection: Method of bonding together, addressing or eliminating leakage through cracks or joints by installing resin under pressure to fill the void in crack or joint.
- G. Hydraulic Structure: Liquid containment structure and/or structure designed to mitigate liquid infiltration.
- H. Defective Area: As defined in Section 03300 Cast in Place Concrete.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Packing and shipping: Package adhesive material in new sealed containers and label with following information:
  - 1. Manufacturer's name.
  - 2. Product name and lot number.
  - 3. ANSI Hazard Classification (formerly SPI Classification).
  - 4. ANSI recommended precautions for handling.
  - 5. Mix ratio by volume.
- B. Storage and protection: Store adhesive containers at ambient temperatures below 120 degrees F and above 32 degrees F.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Epoxy manufacturers:
1. Contech Group, Portland, OR, Seattle, WA.
  2. Sika Corp., Lyndhurst, NJ.
  3. Euclid Chemical Co., Cleveland, OH.
  4. Approved Equal.

### 2.02 EPOXY ADHESIVE

- A. Two-component A and B structural epoxy adhesive for injection into cracks or other voids in concrete structures for bonding or grouting.

- B. Component A properties: Blend of modified epoxy resins as follows:

Color	Test Method	Large Cracks	Small Cracks*
	Visual	Clear Amber Liquid	Light Amber Liquid
Viscosity @ 40, plus or minus 3 deg F	Brookfield RVT Spindle No. 4 @ 200 rpm	8,000 cps, max.	850 cps, max.
Viscosity @ 77, plus or minus 3 deg F	Brookfield RVT Spindle No. 2 @ 20 rpm	700 cps, max.	375 cps max. @ 50 rpm

\*Small crack epoxy blend shall meet requirements for Large Cracks except as shown.

- C. Component B properties: Modified amine curing agent as follows:

Color	Test Method	Large Cracks	Small Cracks*
	Visual	Black Liquid	Black Liquid
Viscosity @ 40, plus or minus 3 deg F, cps	Brookfield RVT Spindle No. 2 @ 20 rpm	1,400 cps, max.	550 cps, max.
Viscosity @ 77, plus or minus 3 deg F, cps	Brookfield RVT Spindle No. 2 @ 20 rpm	240 cps, max.	150 cps max. Using Spindle No. 1 @ 50 rpm

\*Small crack epoxy blend shall meet requirements for Large Cracks except as shown.

- D. Uncured adhesive properties: When mixed in ratio specified on adhesive container label:

	Test Method	Large Cracks	Small Cracks
Pot Life (60-gram mass) @ plus or minus 4 deg F	As specified in this Section	13 to 25 minutes	15 to 30 minutes
Pot Life (60-gram mass) @ 100, plus or minus 3 deg F	As specified in this Section	3 to 10 minutes	10 to 20 minutes
Viscosity @ 40, plus or minus 3 deg F	Brookfield RVT Spindle No. 4 @ 20 rpm	4,400 cps	600 cps
Viscosity @ 75 to 77 deg F	Brookfield RVT Spindle No. 2 @ 20 rpm	375 to 350 cps	175 to 140 cps

- E. Adhesive properties: When cured for 7 days at 77, plus or minus 3 degrees F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

	Test Method	Large Cracks	Small Cracks
Ultimate Tensile Strength, psi	ASTM D638	8,000 min.	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	4.2 max.	3.0 max.
Flexural Strength, psi	ASTM D790	10,000 min.	10,000 min.
Flexural Modulus, psi	ASTM D790	5.5x10 <sup>5</sup> min.	4.5x10 <sup>5</sup> min.
Compressive Yield Strength, psi	ASTM D695*	15,000 min.	12,000 min.
Compressive Modulus, psi	ASTM D695*	4.0x10 <sup>5</sup> min.	4.0x10 <sup>5</sup> min.

	Test Method	Large Cracks	Small Cracks
Heat Deflection Temperature	ASTM D648*	130 deg F min.	140 deg F min.
Slant Shear Strength: (5,000 psi Compressive Strength Conc.)	AASHTO T 237**		
Cured 3 days @ 40 deg F-Wet Concrete			3,500 psi min.
Cured 1 day @ 77 deg F-Dry Concrete			5,000 psi min.
Cured 3 days @ 77 deg plus or minus 3 deg F			5,000 psi min.

\*Cure test specimens so that peak exothermic temperature of adhesive does not exceed 100 degrees F

\*\*See referenced specifications for preparation method of test specimens

## 2.03 SURFACE SEAL

- A. Sufficient strength and adhesion for holding injection fittings firmly in-place, and to resist pressures preventing leakage during injection.
- B. Capable of removal after injection adhesive has cured.

## 2.04 SOURCE QUALITY CONTROL

- A. Test requirements: Perform tests for each batch of adhesive.
- B. Pot life test:
  1. Condition Components A and B to required temperature.
  2. Measure components in ratio of Component B as stated on manufacturer's label into an 8-fluid-ounce paper cup.
  3. Start stopwatch immediately and mix components for 60 seconds using wooden tongue depressor, take care to scrape sides and bottom of cup periodically.
  4. Probe mixture once with tongue depressor every 30 seconds, starting 2 minutes prior to minimum specified pot life.
  5. Pot life definition: Time at which a soft stringy mass forms in center of cup.
- C. Fabrication of slant shear specimens for testing bond of injectable adhesives to wet concrete at 40 Degrees F:
  1. Scope: Test method for preparation of diagonal concrete mortar blocks used in determining slant shear strength of low viscosity injectable adhesives in accordance with AASHTO T 237 when concrete is wet.
  2. Materials:
    - a. Diagonal concrete mortar blocks prepared in accordance with AASHTO Test Method T 237 and cured to produce a mortar with compressive strength of 5,000 psi or greater.
    - b. Paraffin wax.
    - c. Masking tape: 3/4 inch wide.
    - d. Suitable 20-mil thick shim stock.
  3. Preparation:
    - a. Place a 20-mil shim between diagonal faces of two blocks and align so ends and sides are square.
    - b. Bind block with masking tape covering gap between blocks.
    - c. Leave a gap between blocks on one face uncovered for removal of shim and application of adhesive.
    - d. Paint melted paraffin wax over masking tape.
    - e. Shallow dam may be built up around opening using paraffin wax or modeling clay to help retain adhesive.
    - f. Apply suitable capping compound to each end of specimen producing smooth surfaces perpendicular to longitudinal axis of block.
    - g. Remove shim stock from gap opening.

- h. Soak specimen in water at 40 degrees F, plus or minus 3 degrees F for at least 24 hours.
- i. After soaking, remove specimen, shake free water from surface and gap opening.
- j. Prepare liquid adhesive.
- k. Within 5 minutes after removing specimen from water, start flowing adhesive into crack without entrap air bubbles.
- l. Place specimen in 40 degrees F, plus or minus 3 degrees F ambient for curing within 15 minutes after removing specimen from water for bonding. Do not expose specimen to temperatures beyond 77 degrees F during the 15 minute period.
- m. Cure specimen for 72 hours, plus or minus 4 hours at 40 degrees F, plus or minus 3 degrees F.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Structurally repair cracks in structures as specified in Section 03300.
- B. Cracks: Repair by injection of epoxy adhesive.

### **3.02 PREPARATION**

- A. Free cracks from loose matter, dirt, laitance, oil, grease, salt, and other contaminants.
- B. Clean cracks in accordance with epoxy adhesive manufacturer's instructions.
- C. Clean surfaces adjacent to cracks from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system.
- D. Do not use acids and corrosives for cleaning, unless neutralized prior to injecting epoxy.
- E. During installation and curing of materials, if ambient temperature is expected to drop below manufacturer's recommended minimum temperature, provide enclosures and heat as required.
- F. Provide work platforms as required.
- G. Dry out cracks if required by manufacturer's instructions.

### **3.03 APPLICATION**

- A. Sealing: Apply surface seal in accordance with manufacturer's instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.
- B. Entry ports:
  - 1. Establish openings for epoxy entry in surface seal along crack.
  - 2. Determine space between entry ports equal to thickness of concrete member to allow epoxy to penetrate to the full thickness of the wall.
  - 3. Provide a means to prevent concrete dusts and fines from contaminating the crack or ports when drilling.
  - 4. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
    - a. Cracks extend entirely through wall.
    - b. Backfill of walls on one side.
    - c. Difficult to excavate behind wall to seal both crack surfaces.
  - 5. Core drill to verify epoxy depth where only one side of wall is exposed.

- C. Epoxy injection:
  - 1. Store epoxy at minimum of 70 degrees F.
  - 2. Start injection into each crack at lowest elevation entry port.
  - 3. Continue injection at first port until adhesive begins to flow out of port at next highest elevation.
  - 4. Plug first port and start injection at second port until adhesive flows from next port.
  - 5. Inject entire crack with same sequence.
- D. Finishing:
  - 1. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or runback of epoxy material from cracks.
  - 2. Remove surface seal from cured injection adhesive.
  - 3. Finish crack face flush with adjacent concrete.
  - 4. Indentations or protrusions caused by placement of entry ports are not acceptable.
  - 5. Remove surface seal material and injection adhesive runs and spills from concrete surfaces.

### **3.04 EQUIPMENT**

- A. Portable, positive displacement type pumps with in-line metering to meter and mix two adhesive components, and inject mixture into crack.
- B. Pumps:
  - 1. Electric or air powered with interlocks providing positive ratio control of proportions for the two components at nozzle.
  - 2. Primary injection pump for each material of different mix ratio, including a standby backup pump of similar ratio.
  - 3. Capable of immediate compensation for changes in resins.
  - 4. Do not use batch mix pumps.
- C. Discharge pressure: Automatic pressure controls capable of discharging mixed adhesive at pressures up to 200 psi, plus or minus 5 percent, and able to maintain pressure.
- D. Automatic shutoff control: Provide sensors on both Component A and B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.
- E. Proportioning ratio tolerance: Maintain epoxy adhesive manufacturer's prescribed mix ratio within a tolerance of plus or minus 5 percent by volume at discharge pressure up to 160 psi.
- F. Ratio/pressure check device:
  - 1. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
  - 2. Pressure gauge capable of sensing pressure behind each valve.

### **3.05 MANUFACTURER'S SERVICES**

- A. Provide epoxy manufacturer's representative at site for advice on product selection, surface preparation, mixing and installation assistance and inspection and certification of proper installation.

### **3.06 FIELD QUALITY CONTROL**

- A. Independent testing laboratory shall be retained by the Contractor and approved by the Project Representative, and shall perform the following:
  - 1. Epoxy adhesive two component ratio tests:
    - a. Disconnect mixing head and pump two adhesive components simultaneously through ratio check device.
    - b. Adjust discharge pressure to 160 psi for both adhesive components.



- c. Simultaneously discharge both adhesive components into separate calibrated containers.
- d. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
- e. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.
- f. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work as stop for more than 1-hour.
- g. Document and maintain complete accurate records of, ratios and pressure checks.
- 2. Injection pressure test:
  - a. Disconnect mixing head of injection equipment and connect two adhesive component delivery lines to pressure check device.
  - b. Pressure check device:
    - 1) Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
    - 2) Pressure gauge capable of sensing pressure buildup behind each valve.
  - c. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.
  - d. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.
  - e. Run pressure test for each injection equipment unit:
    - 1) Beginning and end of each injection work day.
    - 2) When injection work as stop for more than 45 minutes.
  - f. Check tolerance to verify equipment capable of meeting specified ratio tolerance.
- 3. Crack injection tests:
  - a. Initial cores:
    - 1) 4-inch diameter for full crack depth taken from Project Representative selected locations.
    - 2) Take three cores in first 100 lineal feet of crack repaired and one core sample for each 500 linear feet thereafter.
  - b. Provide suitable containers for storage, curing, and transportation of test specimens.
  - c. Methods of testing cores:
    - 1) Penetration: Visual examination.
    - 2) Bond strength/compression test: Concrete failure prior to adhesive failure.
  - d. Test Requirements:
    - 1) Penetration: Minimum of 90 percent of crack shall be full of epoxy adhesive.
    - 2) Bond strength/compression test: Concrete failure before adhesive failure, or 6,500 psi with no failure of either concrete or adhesive.
  - e. Evaluation and acceptance of tests:
    - 1) If initial cores pass tests as specified, epoxy adhesive injection Work at area represented by cores will be accepted.
    - 2) If initial cores fail either by lack of penetration or bond strength, crack repair Work shall not proceed further until areas represented by cores are reinjected or repaired and retested for acceptance.
    - 3) Obtain verifying core samples, number and location as selected by Project Representative, after rework of areas represented by failed initial cores is complete.
  - f. Core hole repair:
    - 1) Correct Work as result of testing upon notification from Project Representative.
    - 2) Refill initial and verifying core holes with an epoxy grout tamped and rodded in-place to form a dense fill.
      - a) Finish surface to blend with adjacent concrete.

**END OF SECTION**

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**DIVISION 05**

**METALS**

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## SECTION 05050

### WELDING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies welding and testing requirements for all shop and field welding.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASME BPVC SEC V	Nondestructive Examination
ASME BPVC SEC IX	Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders, Brazers, and Welding, Brazing and Fusing Operators
ASNT SNT-TC-1A	Personnel Qualification and Certification in Non-destructive Testing
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
AWS A2.4	Standard Symbols for Welding, Brazing, and Nondestructive Examination
AWS A3.0	Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal spraying
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code – Aluminum
AWS D1.3	Structural Welding Code – Sheet Steel
AWS D1.6	Structural Welding Code – Stainless Steel
AWS QC 1	Standard for AWS Certification of Welding Inspectors

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Shop and field WPSs and PQRs.
- C. Non Destructive Testing (NDT) procedure specifications prepared in accordance with ASME BPVC SEC V.
- D. Shop Drawings:
1. Welding data (shop and field):
    - a. Show on a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tail of welding symbol.
    - b. Clearly distinguish between shop and field welds.
    - c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
    - d. Welding and NDE symbols shall be in accordance with AWS A2.4.
    - e. Welding terms and definitions shall be in accordance with AWS A3.0.
    - f. Submit welding data together with shop drawings as a complete package.

- E. Welder Performance Qualification records and Welders Log.
- F. CWI credentials.
- G. Testing agency personnel credentials.
- H. CWI reports.
- I. Welding documentation: Submit on appropriate forms in referenced welding codes.

#### **1.04 DEFINITIONS**

- A. CJP: Complete Joint Penetration.
- B. CWI: Certified Welding Inspector.
- C. MT: Magnetic Particle Testing.
- D. NDE: Nondestructive Examination.
- E. NDT: Nondestructive Testing.
- F. PJP: Partial Joint Penetration.
- G. PQR: Procedure Qualification Record.
- H. PT: Liquid Penetrant Testing.
- I. RT: Radiographic Testing.
- J. UT: Ultrasonic Testing.
- K. VT: Visual Testing.
- L. WPQ: Welder/Welding Operator Performance Qualification.
- M. WPS: Welding Procedure Specification.

#### **1.05 QUALIFICATIONS**

- A. WPSs: In accordance with AWS D1.1/D1.1M (Annex M Forms) or ASME BPVC SEC IX (Forms QW-482 and QW-483).
- B. WPQs: In accordance with AWS D1.1/D1.1M (Annex M Forms) or ASME BPVC SEC IX (Form QW-484), conducted by Contractor or Manufacturer.
- C. CWI: Certified in accordance with AWS QC 1, and having prior experience with the welding codes specified.
- D. Testing agency: Personnel performing tests shall be NDT Level II Certified in accordance with SNT-TC-1A.

## **1.06 SEQUENCING AND SCHEDULING**

- A. Unless otherwise specified, all Submittals required in this Section shall be submitted and approved prior to commencement of welding operations.

## **PART 2 PRODUCTS**

### **2.01 SOURCE QUALITY CONTROL**

- A. The CWI shall be present whenever shop welding is performed. The CWI shall perform inspection at suitable intervals prior to assembly, during assembly, during welding, and after welding. CWI duties include:
  - 1. Verifying conformance of specified job material and proper storage.
  - 2. Monitoring conformance with approved WPS.
  - 3. Monitoring conformance of WPQ.
  - 4. Inspecting weld joint fit-up and in-process inspection.
  - 5. Providing 100 percent visual inspection of welds.
  - 6. Supervising nondestructive testing personnel and evaluating test results.
  - 7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Welding and fabrication by welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.
- B. Welding procedure specifications for all pressure piping shall be qualified for notch toughness by limiting heat input; charpy testing of weld metal and heat-affected zone shall be done as a part of the welding procedure qualification. Full-size specimens shall be charpy tested in accordance with ASTM A370 at a test temperature of 30 degrees F. The minimum average energy of the test coupons shall not be less than 25 foot-pounds.

### **3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS**

- A. Weld inspection criteria:
  - 1. Unless otherwise specified, perform NDT of welds at a frequency as shown below or in the attached table and in accordance with the referenced welding codes as follows. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply:
    - a. CJP butt joints without backing:
      - 1) 10 percent random RT.
      - 2) Tubular structures welded from one side: in accordance with AWS D1.1, Paragraph 9.26.2.
    - b. All other CJP groove welds: 10 percent random UT.
    - c. Fillet welds and PJP groove welds: 10 percent random PT or MT.
    - d. All welds: 100 percent VT.
  - 2. Weld acceptance:
    - a. VT:
      - 1) Structural pipe and tubing: AWS D1.1, Table 9.16.
      - 2) All other structural steel: AWS D1.1, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
      - 3) Stud connections: AWS D1.1, Paragraph 7.8.1.

- b. UT: CJP groove welds in accordance with AWS D1.1, Paragraph 6.13.1 or 9.27.1, Class R Indications.
- c. RT: CJP butt joint welds in accordance with AWS D1.1, Paragraph 6.12.1 or 9.28.1.
- d. PT or MT: Fillet and PJP groove welds in accordance with AWS D1.1, Paragraph 6.10.

### 3.03 FIELD QUALITY CONTROL

- A. The CWI shall be present whenever field welding is performed. The CWI shall perform inspection at suitable intervals prior to assembly, during assembly, during welding, and after welding. CWI duties include:
  - 1. Verifying conformance of specified job material and proper storage.
  - 2. Monitoring conformance with approved WPS.
  - 3. Monitoring conformance of WPQ.
  - 4. Inspecting weld joint fit-up and in-process inspection.
  - 5. Providing 100 percent visual inspection of all welds.
  - 6. Supervising nondestructive testing personnel and evaluating test results.
  - 7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

### 3.04 WELD DEFECT REPAIR

- A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

### 3.05 SUPPLEMENTS

- A. The supplement listed below.
  - 1. Welding and Nondestructive Testing table.

**WELDING AND NONDESTRUCTIVE TESTING**

Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
05120	AWS D1.1, Structural Welding Code – Steel	Yes	Yes	Yes	Yes	100% VT and as specified herein
05310	AWS D1.1, Structural Welding Code – Steel or AWS D1.3, Structural Welding Code – Sheet Steel	Yes	Yes	Yes	No	100% VT; see Section 05310
05400	AWS D1.1, Structural Welding Code – Steel or AWS D1.3, Structural Welding Code – Sheet Steel	No	Yes	Yes	No	100% VT; see Section 05400
05500	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, Structural Welding Code – Aluminum or AWS D1.6, Structural Welding Code – Stainless Steel	Yes	Yes	Yes	No	100% VT and as specified herein



# **WELDING AND NONDESTRUCTIVE TESTING**

Specificati on Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
05520	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, Structural Welding Code – Aluminum	No	No	No	No	100% VT
05530	AWS D1.1, Structural Welding Code – Steel or AWS D1.2, Structural Welding Code – Aluminum	No	No	No	No	100% VT
15061	AWS D1.1, ASME IX	Yes	Yes	Yes	Yes	100% VT; see Section 15060

**END OF SECTION**

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## SECTION 05120

### STRUCTURAL STEEL

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies structural steel framing, anchor bolts, high strength bolts, base plates, structural frame accessories and shop finishing.
- B. The requirements in this Section are part of the overall requirements to comply with a Certified Platinum Rating of the Envision Rating System for Sustainable Infrastructure. Materials and products shall meet the requirements as defined in Section 01350.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AISC 348	Specification for Structural Joints using High-Strength Bolts
AISC 303	Code of Standard Practice for Steel Buildings and Bridges, excluding Sections 3, 4, 7.2, 7.11.3, 4, 7.11.4 and 7.11.5
AISC 206	Erector Certification Program
AISC 325	Steel Construction Manual
AISC	Quality Certification Program
AISC 360	Specification for Structural Steel Buildings
ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Steel Piling
ASTM A36	Standard Specification for Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143	Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A325	Standard Specification for High-Strength Bolts for Structural Steel Joints
ASTM A384	Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A490	Standard Specification for Heat-Treated Steel Structural bolts, 150 ksi Minimum Tensile Strength
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992	Standard Specification for Steel for Structural Shapes for Use in Building Frames
ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM F436	Standard Specification for Hardened Steel Washers

<u>Reference</u>	<u>Title</u>
ASTM F1852	Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength
AWS D1.1	Structural Welding Code-Steel
SBC	Seattle Building Code
ASTM A6	Mill identification marks
AGA	Quality Assurance Manual of the American Galvanizers Association

- B. Qualifications:
  1. Welding qualifications as specified in Section 05050, Welding.
  2. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of AGA's Quality Assurance Manual.
- C. Certifications:
  1. Mill identification marks, heat number, size of section, and length in accordance with ASTM A6/A6M.
  2. AISC Quality Certification for Fabricator: A fabricator who participates in the AISC Certification program and is designated an AISC certified plant, Category STD.
  3. AISC Quality Certification for Erector: An installer who participates in the AISC Certification program and is designated an AISC Certified Erector, Category CSE.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Shop drawings:
  1. Erection drawings.
  2. Members, including piece numbers, sizes, grades, dimensions, cambers, and connection details.
  3. Anchor bolt layouts.
  4. Hardened washer details.
  5. Connection material specifications.
  6. Type, size, and length of bolts.
  7. Joint details for complete penetration welds.
  8. Schedules for fabrication procedures.
  9. Primer and other coatings.
- C. Name and address of manufacturer(s) for products used.
- D. Product specifications, including primer and other coatings.
- E. Manufacturer's testing procedures and standards.
- F. Preparation and installation or application instructions, as appropriate.
- G. Mill Certificates of tests made in accordance with ASTM A6.
- H. High-strength bolts (plain non-coated and hot-dip galvanized):
  1. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
  2. Manufacturer's inspection test report results for production lot(s) furnished, to include:
    - a. Tensile strength.
    - b. Yield strength.
    - c. Reduction of area.
    - d. Elongation and hardness.

3. Certified mill test reports for bolts and nuts:
  - a. Name and address of manufacturer.
  - b. Bolts correctly marked.
  - c. Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.
- I. Identify pretensioned and slip-critical high strength bolted connections.
- J. Locations of Class A, or higher, faying surfaces.
- K. Weld access hole dimensions, surface profile, and finish requirements.
- L. Location of demand critical shop welds.
- M. Locations and dimensions of protected zones.
- N. Gusset plates drawn to scale when they are detailed to accommodate inelastic rotation.
- O. Nondestructive testing (NDT) when performed by the fabricator.
- P. Direct tension indicators (DTIs): Furnish manufacturer's test report meeting requirements of ASTM F959.
- Q. Tension control (TC) bolts: Furnish manufacturer's test report meeting requirements of ASTM A325 and ASTM F1852.
- R. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.
- S. Welding Data: As specified in Section 05050.
- T. Hot-dip galvanizing: Certificate of compliance signed by galvanizer with description of material processed and ASTM standard used for coating.
- U. AISC quality certification: AISC certificate showing name and address of certified firm, effective date, and category of certification; or, for erectors, documentation of similar project experience to include project name, location, date of completion, and name and phone number of owner's contact person.
- V. Fabricator Certification: Conventional Steel Building Structures (SBD).
- W. Certified Steel Erector (CSE), or documented experience in erection of at least 10 years in lieu of AISC certification.
- X. Technical data on steel primer to be used.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
- B. Storage:
  1. Protect structural steel members and packaged materials from corrosion and deterioration.
  2. Store in dry area and not in direct contact with ground.
  3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.
- C. Handle materials to avoid distortion or damage to members or supporting structures.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Rolled plates, shapes except W-shapes, and bars: ASTM A36, unless indicated otherwise.
- B. W-shapes:
  - 1. ASTM A992.
  - 2. Plate Material for frame connections: ASTM 572, Grade 50 unless indicated otherwise.
- C. Steel pipe: ASTM A53, Type E or S, Grade B.
- D. Round hollow structural sections (HSS): ASTM A500, Grade B (Fy equals 42 ksi).
- E. Square and rectangular hollow structural sections (HSS): ASTM A500, Grade B (Fy equals 46 ksi).

### **2.02 FASTENERS**

- A. Anchor bolts: As specified in Section 05501.
- B. Post-installed Anchors: As specified in Section 05501.
- C. High-strength bolts: ASTM A325, bolt type 1, galvanized, or ASTM A490, bolt type 1, plain uncoated. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.
- D. Direct tension indicators (DTIs) or load indicator washers:
  - 1. ASTM F959, coating type to match bolt finish.
  - 2. Type A325 or A490, to match bolt type.
  - 3. Manufacturers and products:
    - a. TurnaSure LLC; DTI's.
    - b. Applied Bolting Technology Products; DTI's, regular or Squirter type.
    - c. Approved Equal.
- E. Tension control (TC) bolts:
  - 1. High-strength, ASTM A325 and F1852.
  - 2. Manufacturers:
    - a. LeJeune Bolt Company.
    - b. Nucor Fastener.
    - c. Haydon Bolts.
    - d. Vermont Fasteners Manufacturing.
    - e. Approved Equal.
- F. Nuts: ASTM A563, type to match bolt type and finish.
- G. Hardened Steel Flat and Beveled Washers: ASTM F436, type to match bolt finish.
- H. Welded Anchor Studs: As specified in Section 05500.

### **2.03 ANCILLARY MATERIALS**

- A. Surface preparation and primer: As specified in Section 09900. Primer to be used on structural steel shall conform to the requirements of Section 09900 and shall be compatible with the final finish coats required in Section 09900 and Section 09901. Submit technical data on primers.

- B. Grout: As specified in Section 03600.

## **2.04 FABRICATION**

- A. General:
1. Fabricate as shown and in accordance with AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges.
  2. Columns shall be full length members without splices, unless shown otherwise or accepted by Project Representative.
  3. Mark and match mark materials for field assembly.
  4. Complete assembly, including bolting and welding of units, before start of finishing operations.
  5. Fabricate to agree with field measurements.
  6. Provide camber as indicated in the Drawings.
- B. Connections:
1. Shop connections: Weld or bolt, as shown.
  2. Meet requirements of AISC Manual of Steel Construction tables for bolted double-angle shear connections, unless indicated otherwise.
  3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.
  4. Provide oversized holes for anchor bolts in column base plates in accordance with AISC Manual of Steel Construction, unless indicated otherwise.
- C. Welded construction:
1. Groove welds: Complete joint penetration, unless otherwise indicated.
  2. Meet requirements of AWS D1.1 and Section 05050.
- D. Interface with other work:
1. Holes:
    - a. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
    - b. No flame-cut holes will be permitted without prior approval of Project Representative.
  2. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.
- E. Architecturally Exposed Structural Steel (AESS): Fabricate in accordance with AISC 303, Section 10.
- F. Shop paint primer:
1. All structural steel requiring painting shall be shop primed and field finished as specified in Section 09900 and Section 09901.
  2. Surface preparation and painting as specified in Section 09900.
  3. Do not shop prime the following surfaces, unless indicated otherwise:
    - a. Faying surfaces of slip critical bolted connections.
    - b. Within 2 inches of field-welded connections.
    - c. Steel members to be completely encased in reinforced concrete or coated with cementitious fireproofing.
  4. Apply shop primer to top flange surfaces of composite steel beams unless indicated otherwise.
- G. Galvanizing:
1. Fabricate steel to be galvanized in accordance with ASTM A143, A384, and A385. Avoid fabrication techniques that could cause distortion or embrittlement of steel.
  2. Provide venting and drain holes for tubular members and in accordance with ASTM A385.
  3. Remove welding slag, spatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
  4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.

5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123.
  6. Hot-dip galvanize A325 bolts, nuts, washers, and hardware components in accordance with ASTM A153. Oversize holes to allow for zinc alloy growth. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A325 and A563.
  7. Tension-control (TC) bolts, nuts, and washers shall be mechanically zinc coated in accordance with ASTM F1852 and B695, Class 50.
  8. Galvanize components of bolted assemblies separately before assembly.
- H. Slip critical bolted connections:
1. Mask faying surfaces of slip critical (SC) bolted connections to be shop painted as specified in Section 09900.
  2. Roughen galvanized faying surfaces with hand wire brushing.

## **2.05 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 ERECTION**

- A. Meet requirements of AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges, with exceptions as specified.
- B. Install Contractor-designed temporary construction bracing to provide necessary support until components are in place and construction is complete.
- C. Establish permanent benchmarks necessary for the accurate erection of structural steel.
- D. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar items, before erection proceeds.
- E. Splice members only where indicated and accepted on shop drawings.
- F. High-strength bolted connections:
  1. Tighten in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 bolts.
  2. Hardened washers:
    - a. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, to include slip critical connections using slotted or oversized holes or A490 bolts.
    - b. Use beveled style and extra thickness where required by AISC Specification.
    - c. Use square or rectangular beveled washers at inner flange surfaces of American Standard beams and channels.
    - d. Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.
  3. For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.
- G. Fully tensioned bolted connections:
  1. Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing-type connections.
  2. DTIs:
    - a. Position within bolted assembly in accordance with ASTM F959.
    - b. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.



3. Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist-off of TC bolts or until DTIs have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

H. Welded connections:

1. As shown on the approved shop drawings.
2. Meet requirements of AWS D1.1 and Section 05050.
3. Groove Welds: Complete penetration, unless otherwise indicated.

### **3.02 ANCHOR BOLTS**

- A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.
- B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.
- C. Projection of anchor bolts beyond face of concrete and threaded length shall be adequate to allow for full engagement of all threads of hold-down nuts, adjustment of leveling nuts, washer thicknesses, and construction tolerances, unless indicated otherwise.
- D. Placement tolerances:
  1. As required by AISC Code of Standard Practice for Steel Buildings and Bridges, unless indicated otherwise.
  2. Embedded anchor bolts shall not vary from the dimensions as indicated in the Drawings by more than the following:
    - a. Center to center of any two bolts within an anchor group: 1/8 inch.
    - b. Center to center of adjacent anchor bolt groups: 1/4 inch.
    - c. Variation from perpendicular to theoretical bearing surface: 1:50.

### **3.03 SETTING BASES AND BEARING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces.
- B. Clean bottom surface of base and bearing plates.
- C. Set loose and attached base plates and bearing plates for structural members on wedges, shims, leveling nuts, or other adjustable devices. Use leveling plates where indicated.
- D. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout. Weld plate washers to base plates where indicated.
- E. Grout under base plates: As specified in Section 03600, prior to placing loads on structure.

### **3.04 FIELD ASSEMBLY**

- A. Set structural frames accurately to lines and elevations shown.
- B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
- C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

- D. Level and plumb individual members of structure within tolerances shown in AISC Code of Standard Practice for Steel Buildings and Bridges.
- E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.
- F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.
- G. Do not field cut or alter structural members without approval of Project Representative.
- H. Provide additional field connection material as required by AISC Code of Standard Practice for Steel Buildings and Bridges.
- I. Splice members only where indicated and accepted on shop drawings.

### **3.05 MISFITS AT BOLTED CONNECTIONS**

- A. Where misfits in erection bolting are encountered, immediately notify Project Representative for approval of one of the following methods of correction:
  - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
  - 2. Plug weld misaligned holes and redrill holes to admit standard size bolts.
  - 3. Drill additional holes in connection, conforming to AISC Standards for bolt spacing and end and edge distances, and add additional bolts.
  - 4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.
- B. Do not enlarge incorrectly sized or misaligned holes in members by burning or by use of drift pins.

### **3.06 MISFITS AT ANCHOR BOLTS**

- A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.
- B. Do not flame cut to enlarge holes without prior approval of Project Representative.

### **3.07 GAS CUTTING**

- A. Do not use gas-cutting torches for correcting fabrication errors in structural framing.
- B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if accepted by Project Representative.
- C. Finish flame-cut sections equivalent to sheared and punched appearance.

### **3.08 REPAIR AND CLEANING**

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.
- B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.
- C. Remove weld back-up bars and grind smooth where indicated in the Drawings.
- D. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application and as specified in Section 09900.

### **3.09 REPAIR OF DAMAGED HOT-DIP GALVANIZED COATING**

- A. Conform to ASTM A780.
- B. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
- C. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
- D. Use magnetic gauge to determine that thickness is equal to or greater than base galvanized coating.

### **3.10 FIELD QUALITY CONTROL**

- A. Owner-Furnished Quality Assurance, in accordance with SBC Chapter 17 requirements, as provided in Statement of Special Inspections Plan in the Drawings. Contractor responsibilities and related information are included in Section 01410.
- B. Quality Control Program: Inspect and test as required in Section 01430.
- C. High-strength bolted connections:
  - 1. Inspect
    - a. Marking identification and conformance to ASTM standards.
    - b. Alignment of bolt holes.
    - c. Placement, type, and thickness of hardened washers.
    - d. Tightening of bolts.
  - 2. Bearing-type connections not fully tensioned (N, X): Snug tight condition with plies of joint in firm contact.
  - 3. Fully tensioned (FT) bearing and slip critical (SC) connections:
    - a. Conduct pre-installation test.
    - b. Monitor installation and tightening of DTIs or TC bolts.
    - c. Monitor condition of faying surfaces for slip critical connections.
  - 4. Pre-installation test:
    - a. Conduct jobsite test prior to start of work using a bolt tension measuring device.
    - b. Select representative sample of not less than three bolts of each diameter, length, and grade.
    - c. Include DTIs and flat hardened washers as required to match actual connection assembly.
    - d. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or A490 Bolts.
  - 5. Nondestructive testing (NDT) report: Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.
  - 6. Defective connections: Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.
- D. Welded connections:
  - 1. Contractor's Certified Welding Inspector (CWI) shall be present whenever welding is performed.
  - 2. Nondestructive Testing: Frequency and acceptance criteria as specified in Section 05050.
  - 3. Repair and retest defective welds per AWS D1.1, Section 5.25.
- E. Welded anchor studs:
  - 1. Inspect and test welded anchor studs per Section 05500 and 05050 .

**END OF SECTION**

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## SECTION 05310

### STEEL DECK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies fabrication and erection of steel roof and floor deck.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AISI	Specifications for the Design of Cold Formed Steel Structural Members
ASTM A611	Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas Hot-Dip Galvanized
ASTM A924	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
AWS D1.3	Structural Welding Code - Sheet Steel
FM Global Data Sheet 1-28	Wind Design
FM Global Data Sheet 1-29	Roof Deck Securement for Above-Deck Roof Components
SBC	Seattle Building Code
ICC-ES	International Code Council Evaluation Services
DSI	Design Manual for Composite Decks, Form Decks and Roof Deck, Diaphragm Design Manual
UL	Fire Resistance Directory

- B. General: For metal decking section properties, meet requirements of AISI Specifications for Design of Cold-Formed Steel Structural Members.
- C. Mechanical Fasteners: Packing containers shall show name of manufacturer and product and FMRC approval mark.
- D. Qualifications for Field Welding: As specified by AWS.
- E. Erector Qualifications: Minimum of three years experience on comparable steel deck projects.
- F. Install steel deck to meet requirements of the SBC.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.

- B. Shop drawings:
  - 1. Plan view layout of decking, showing type and section properties of deck panels, reinforcing channels, pans, special jointing, and accessories.
  - 2. Location of openings, deck laps, and deck attachment details.
  - 3. Details of accessories, showing sump pans, ridge and valley plates, and closure strips.
  - 4. Location of temporary shoring for placement of concrete topping.
- C. Decking manufacturer's installation requirements, fastening specifications, and data sheets.
- D. Welding Procedures, Qualifications, and Inspection Report as specified in Section 05050.
- E. Operation manuals for mechanical fastener installation tools.
- F. Manufacturer's Certificate of Compliance.
- G. RoofNav Contractor Package.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store deck bundles on platforms or pallets, with one end elevated to provide drainage.
- C. Protect bundles against condensation with a ventilated waterproof covering.
- D. Stack bundles so there is no danger of tipping, sliding, rolling, shifting or material damage.
- E. Architecturally exposed deck shall be appropriately packaged and protected to prevent damage during shipment.

### **PART 2 PRODUCTS**

#### **2.01 METAL DECKING**

- A. Provide metal deck as indicated in the Drawing.
- B. Use assemblies listed in the online database RoofNav application at [www.roofnav.com](http://www.roofnav.com), with an FM Global windstorm classification of 1A-60.
- C. Materials and Finishes:
  - 1. Galvanized Deck:
    - a. Sheet steel for galvanized deck and accessories shall conform to ASTM A653 Structural Quality Grade 33 or higher, as shown in Steel Deck Schedule.
    - b. Galvanizing shall conform to ASTM A924 with coating class of G90 as defined in ASTM A653.
- D. Manufacturers:
  - 1. Vulcraft Division of Nucor Co.
  - 2. Verco Manufacturing, Inc.
  - 3. United Steel Deck, Inc.
  - 4. Approved Equal.

## **2.02 SHOP PRIMER**

- A. Not Used.

## **2.03 ACCESSORIES**

- A. Provide pour stops, column closures, end closures, edge closures, cover plates, girder fillers, ridge and valley plates, finish strips, reinforcing channels, and other accessories as indicated for complete installation.
- B. Accessories shall comply with requirements of SDI and deck manufacturer.

## **2.04 MECHANICAL FASTENERS**

- A. Self-Drilling Screws:
  - 1. Self-drilling, self-tapping screws with hexagonal washer head and corrosion-resistant finish.
  - 2. Manufacturers and Products:
    - a. ITW Buildex; ICH Traxx Self-Drilling Fasteners with Climaseal Coating and Autotraxx Standup Installation Tool.
    - b. Hilti, Inc.; Kwik-Pro HWH Self-Drilling Screws with Kwik-Cote Treatment and Kwik-Tapper Screwdriver.
    - c. Approved Equal.

## **2.05 SHEAR CONNECTORS FOR COMPOSITE DECK**

- A. Welded headed anchor studs: Size and spacing as indicated in the Drawings and as specified in Section 05500.

## **2.06 FIELD FINISH**

- A. Steel deck requiring field finish shall be in accordance with Section 09900 and Section 09901.

## **2.07 ROOF INSULATION**

- A. As specified in Section 07210.

## **2.08 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.
- B. Verify that surfaces to receive steel deck are free of debris.
- C. Do not proceed with installation until defects are corrected.
- D. Coordinate work with requirements of mechanical equipment installation requirements.

### 3.02 INSTALLATION

- A. Install deck units and accessories in accordance with manufacturer's recommendations and shop drawings.
- B. Install additional fastening at the perimeters and corners per Data Sheet 1-29, *Roof Deck Securement for Above-Deck Roof Components*, and the roof system's approval listing.
- C. Locate deck bundles to prevent overloading of support framing members.
- D. Install at right angles to supporting members in a three span minimum lay-up, unless shown otherwise, and in accordance with Specification and manufacturer's installation recommendation.
- E. Bearing: 1-1/2 inches, minimum.
- F. Minimum of 2 inches and located over supports.
- G. Do not stretch side laps.
- H. Closure Plates:
  - 1. Install closure and cover plate accessories as recommended by SDI.
  - 2. Floor Deck and Form Deck Closures:
    - a. Fasten column closures, cell closures, and zee closures to deck to provide tight fitting closures at open ends of ribs and sides of decking.
    - b. Fasten cell closures at changes of direction of deck units unless otherwise indicated.
- I. Holes and Openings:
  - 1. Cut and fit roof deck units and accessories around projections through roof decking.
  - 2. Make cuts neat, square, and trim.
  - 3. Cut openings in roof deck true to dimensions using metal saws or drills.
  - 4. Do not use cutting torches if neat appearance is required.
  - 5. Locate holes and openings as shown to clear structural framing and bracing members.
  - 6. Reinforcement Around Openings:
    - a. Roof Deck: For hole sizes of at least 6 inches across, but not more than 12 inches across in roof deck, reinforce with 0.0474-inch design thickness steel plate, painted or galvanized to match deck coating. Extend plate at least 12 inches beyond opening in all directions and attach to top of roof deck with No. 10 self-drilling screws at 6-inch spacing and at all corners. For openings larger than 12 inches across, reinforce roof deck with framing as indicated in the Drawings.
    - b. Composite Floor Deck and Form Deck: Reinforce openings as indicated in the Drawings.
- J. Protect deck areas from heavy concentrated loads or wheel traffic with planking or other approved means.
- K. Install temporary shoring, if required, to meet strength and deflection limitations, before placing any concrete topping on deck panels.
- L. Completed Deck: Free from buckles and irregularities, and in accordance with FM and UL requirements.

### 3.03 DECK ATTACHMENT

- A. Fasten panels as indicated in the Drawings.



- B. Welded Connections: Weld deck sidelaps, attachment to framing, and accessories in accordance with AWS D1.3.
- C. Mechanical Fasteners:
  - 1. Self-Drilling Screws:
    - a. Install screws in accordance with manufacturer's written instructions and with special installation tool. Do not over-torque.
    - b. Remove and redrive screws at side laps where upper sheet is not drawn tightly against lower sheet.

### **3.04 TOUCHUP PAINTING**

- A. Immediately following erection, remove unused deck edge trimmings, screws, fasteners, welding washers, butt ends of welding rods, and debris from completed installation.
- B. Clean field welds, bolted connections, rust spots, and abraded areas.
- C. Repair damaged galvanized surfaces in accordance with Section 05500.
- D. Use magnetic gauge to determine that thickness of repair is equal to or greater than base galvanized coating.

### **3.05 PROTECTION**

- A. Do not use deck units for storage or working platforms until permanently secured in position.
- B. Assure that construction loads do not exceed carrying capacity of deck.
- C. Replace damaged or warped panel.

### **3.06 FIELD QUALITY CONTROL**

- A. Inspect:
  - 1. Welded Connections: Visually inspect in accordance with AWS D1.3.
  - 2. Mechanical Fasteners: Visually inspect, in accordance with manufacturer's instructions, for each type of fastener.
- B. Repair or replace defective welds and fasteners.
- C. Welded Anchor Studs: Inspect and test as specified in Section 05500.

**END OF SECTION**

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## SECTION 05400

### COLD-FORMED STEEL FRAMING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies cold-formed steel framing. Contractor responsible for design of cold-formed steel framing.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AISI	Specification for the Design of Cold-Formed Steel Structural Members
AISI	Cold-Formed Steel Design Manual
AISI	Fasteners for Residential Steel Framing
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanize Coating
ASTM C955	Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
AWS C1.1	Recommended Practices for Resistance Welding
AWS C1.3	Recommended Practices for Resistance Welding Coated Low Carbon Steels
AWS D1.3	Structural Welding Code-Sheet Steel
SBC	Seattle Building Code
ICC	International Code Council Evaluation Reports for Cold-Formed Steel Framing and Fasteners
MLA	Specification for Metal Lath and Furring

- B. Standard Specifications: Comply with the requirements of the following standard specifications except as supplemented and modified hereinafter:
1. For Light-Gage Sheet Metal Framing: MLA.
  2. For Light-Gage Stud Framing: AISI.
- C. Member section properties shall meet requirements of AISI, Specification for the Design of Cold-Formed Steel Structural Members.
- D. Qualifications for Welding: As specified by AWS.
- E. Design Criteria: Load criteria, Dead, Live, Wind, Seismic, and mechanical and electrical components as indicated in the Drawings.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.

- B. Manufacturer Data: Submit manufacturer's data, specifications and installation instructions for cold-formed metal framing.
- C. Shop drawings:
  - 1. Plan and elevation views of all metal framing systems, including location and framing of all openings.
  - 2. Material specifications, member sizes, and properties.
  - 3. Details of track, web stiffeners, stud bracing, blocking, bridging, and other members as required to provide a complete installation.
  - 4. Details of connections including welding, mechanical fasteners, and accessory items.
- D. Operation manuals for mechanical fastener installation tools.
- E. Complete design and calculations for structural metal stud framing systems as indicated in the Drawings, and as required by SBC. Design shall include, but is not limited to, member stresses, design loads, member sizes, and all connections. Design must be stamped by a registered professional engineer valid in the State of Washington. Include calculations for anchorage connections to resist wind lateral and uplift loads.
- F. Welding Procedures, Qualifications, and Inspection Report, as specified in Section 05050.

#### **1.04 WELDING**

- A. Welding Data: As specified in Section 05050.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver to Site in bundles marked with name of manufacturer, section type, thickness, grade of material, and length.
- B. Store bundles on wood blocking, flat and off ground, to keep clean and to prevent any damage or permanent distortion.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Provide size and type of members as indicated in the Drawings.
- B. Cold-formed metal framing shall be formed from steel sheets complying with ASTM A653, with G-60 hot-dip galvanized coating.
- C. Cold-Formed Members and Accessories shall conform to ASTM C955.
- D. Dimensions and Properties: Calculate section properties in accordance with AISI Cold-Formed Steel Design Manual.
- E. Acceptable Manufacturers and Products:
  - 1. Scafco Corp.
  - 2. Clark Steel, Steel Framing Systems.
  - 3. Dietrich Industries, Light gauge Metal Framing Products.
  - 4. Knorr Steel Framing Systems, Light Gauge Steel Framing.
  - 5. Marino/Ware, Stud-Rite Lightweight Steel Framing Systems.
  - 6. Unimast Incorporated, Steel Framing Systems.
  - 7. Approved Equal.

## **2.02 RUNNERS**

- A. Galvanized steel channel sections with not less than 1-1/4-inch flanges; widths and gage to suit studs, unpunched as indicated in the Drawings.

## **2.03 STUDS**

- A. ASTM A653/A653M, Structural Steel (SS) Grade 33, or High-Strength Low-Alloy Steel (HSLAS), Type A or B, Grade 50.
- B. Type, size, and spacing as required by design or as indicated in the Drawings.
- C. Punched to receive mechanical and electrical work; suitable to receive finishes specified.
- D. Provide 16-gage double studs at door jambs, typical.

## **2.04 FURRING CHANNELS**

- A. Roll-formed channel shaped, 25-gage galvanized steel with knockouts for conduit installations suitable to receive wallboard attached with self-drilling drywall screws at furred walls to receive insulation or concealed electrical conduit. Size and shape as indicated in the Drawings.

## **2.05 BRIDGING, BLOCKING, AND FIRE STOPS**

- A. Same depth as studs or joists, 0.0566-inch minimum design thickness, unpunched.

## **2.06 ACCESSORY MATERIAL**

- A. Bracing Straps, Angle Bracing, Clip Angles: Size and thickness as indicated in the Drawings.
- B. Mounting Plates: 0.0566-inch minimum design thickness by 8 inches by 18 inches.
- C. All incidental and accessory materials, methods, tools and equipment are required for the satisfactory fabrication and erection of framing, as indicated in the Drawings, including fasteners, attachments and anchorages to building construction.

## **2.07 MECHANICAL FASTENERS**

- A. Self-Drilling Screws:
  - 1. Self-drilling, self-tapping screws with hexagonal washer head and corrosion-resistant finish.
  - 2. Manufacturers and Products:
    - a. ITW Buildex; ICH Traxx Self-Drilling Fasteners with Climaseal Coating and Autotraxx Standup Installation Tool.
    - b. Hilti, Inc.; Kwik-Pro HWH Self-Drilling Screws with Kwik-Cote Treatment and Kwik-Tapper Screwdriver.
    - c. Approved Equal.
- B. Powder-Driven Fasteners:
  - 1. Knurled shank, minimum 1/2-inch diameter steel washer, corrosion-resistant coating.
  - 2. Pin diameter and length to suit deck type and flange thickness of steel support member.
  - 3. Manufacturers and Products:
    - a. ITW Buildex; Buildex BX14 pins with yellow dichromate galvanizing and BX900 Installation Tool.
    - b. Hilti, Inc.; ENP-series fasteners with electroplated zinc coating and DX-750 Installation Tool.
    - c. Approved Equal.

## **2.08 CONCRETE ANCHORS**

- A. Drilled anchors, size and type as indicated in the Drawings and as specified in Section 05501.

## **2.09 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Inspect all prefabricated assemblies and repair any damage.
- B. Examine bearing support surfaces for compliance with requirements for installation tolerances and other conditions affecting performance of metal framing systems.
- C. Provide smooth level bearing surfaces for bottom track of load bearing walls.
- D. Clean all member and bearing surfaces that will be in contact after assembly.

### **3.02 ERECTION OF STUDS**

- A. Install tracks in accurate alignment in accordance with approved layouts and manufacturer's recommendations; secure to building construction, as indicated in the Drawings; where not indicated in the Drawings, provide minimum 5/16-inch diameter power-driven fasteners at 16 inches on center. Position studs in tracks and secure, as indicated in the Drawings. Space studs no more than 16 inches on center.
- B. Provide jack studs between bottom track and sills of openings, and between top track and sills of openings, and between top track and headers and lintels of openings. Locate studs no more than two inches from all abutting partitions, partition corners, door frames, jambs and other interrupting construction.
- C. At door jambs and at free ends of partitions, provide 16-gage doubles studs placed back to back. Above and below openings, provide cut studs, as necessary to maintain the specified stud spacing.
- D. Install framing in true line, plumb, level, and in proper alignment.
- E. Cut ends of framing members with saw or shear to bear uniformly against abutting members. Flame cutting is not permitted.
- F. All structural framing members shall be full-length without splices, unless indicated otherwise.
- G. Web Penetrations:
  - 1. Drilled holes for other trades shall be limited to the middle 1/3 of the joist depth within the middle 1/3 of the span, unless indicated otherwise. Minimum spacing between drilled holes shall be 1-1/2 times the joist depth. Notching of joist flanges and flame cutting of holes are not permitted.
- H. Fasten members together in accordance with AISI, Cold-Formed Steel Design Manual, Part IV, Connections. Wire tying is not permitted.

### **3.03 HORIZONTAL BRACING**

- A. Provide horizontal bracing consisting of hot or cold-rolled channels inserted through cutouts in the web of each stud and secured to each stud with tie wire. Provide 1 row of channels at mid-height for partitions up to 10 feet between runners, and 2 rows at 1/3 points for partitions over 10 feet between runners. Use 1-1/2-inch channels for partitions higher than 14 feet between runners and longer than 1-1/2 times the height, and 3/4-inch channel above the header of doors and other large openings. Extend bracing to engage first stud beyond each jamb stud.

### **3.04 BLOCKING AND REINFORCING FOR WALL-HUNG ITEMS**

- A. Provide cut sections or runner channel, zinc coated steel backing plates, doubled and nested studs, load bearing studs and other items, as indicated, for the support of wall-hung fixtures, shelving, cabinets, hand rails and toilet accessories. Cut ends of runner and backing plates to each stud. Fasten studs carrying the weight of wall-hung items to the bottom runner channel.

### **3.05 FASTENERS**

- A. Self-Drilling Screws:
  - 1. Install in accordance with manufacturer's written instructions and with special installation tool.
  - 2. Screw type, diameter, and length shall be in accordance with AISI, Fasteners for Residential Steel Framing, minimum two screws per connection unless indicated otherwise.
  - 3. Use clamp to hold members together. Drive screw from lighter to heavier gauge, to allow plies to be pulled together without stripping metal. Do not over torque. A minimum of three exposed threads shall extend through steel.
  - 4. Minimum screw spacing, end distance, and edge distance shall be 3 diameters.
- B. Powder-Driven Fasteners:
  - 1. Use only for connecting cold-formed steel to structural steel members, unless indicated otherwise.
  - 2. Install in accordance with manufacturer's written instructions and with special installation tool.
- C. Welded Connections:
  - 1. Welding shall not be used for material thinner than 0.0451 inch.
  - 2. Weld framing members and accessories in accordance with AWS D1.3.
  - 3. Resistance welding for prefabricated framing shall be in accordance with AWS C1.1 and AWS C1.3.
  - 4. Repair galvanized surfaces damaged by welding with zinc-rich spray paint in accordance with ASTM A780.
- D. Concrete Anchors: Install in accordance with Section 05501.

### **3.06 FIELD QUALITY CONTROL**

- A. Perform the following inspections.
  - 1. Welded Connections: 100 percent visually inspection by Contractor's CWI in accordance with AWS D1.3, Section 6 and as specified in Section 05050.
  - 2. Mechanical Fasteners: Visually inspect, in accordance with manufacturer's instructions, for each type of fastener.
- B. Repair or replace defective welds and fasteners.

- C. Prepare and repair damaged galvanized coatings on fabricated and installed cold-form steel framing with galvanizing repair paint according to ASTM A780 and the manufacturer's instructions.

**END OF SECTION**



## SECTION 05500

### METAL FABRICATIONS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies fabricated metal items and other miscellaneous metalwork, galvanized or coated. The tabulation of items herein is not intended to be all inclusive, and it shall be the Contractor's responsibility to provide all metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the Project.
- B. The requirements in this Section are part of the overall requirements to comply with a Certified Platinum Rating of the Envision Rating System for Sustainable Infrastructure. Materials and products shall meet the requirements as defined in Section 01350.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI/NAAMM MBG 531	Metal Bar Grating Manual
ASME Section V	Boiler and Pressure Vessel Code : Nondestructive Examination
ASME Section IX	Boiler and Pressure Vessel Code: Welding and Brazing Qualifications
ASTM A29	General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A36	Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A123	Zinc (Hot-Dip Galvanize) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM A193	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both
ASTM A240	Heat-Resisting Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A242	High-Strength Low-Alloy Structural Steel
ASTM A276	Stainless Steel Bars and Shapes
ASTM A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A312	Seamless and Welded Austenitic Stainless steel Pipes
ASTM A320	Alloy Steel Bolting Materials for Low Temperature Service
ASTM A325	Structural Bolt, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A479	Stainless Steel Bars and Shapes for Pressure Vessels
ASTM A496	Steel Wire, Deformed, for Concrete Reinforcement
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A588	High-Strength Low-Alloy Structural Steel, up to 50 Ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance

<u>Reference</u>	<u>Title</u>
ASTM A606	Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A780	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786	Rolled Steel Floor Plates
ASTM A793	Rolled Floor Plate, Stainless Steel
ASTM A847	Cold-Formed Welded and Seamless High-Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210	Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B211	Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B632	Aluminum-Alloy Rolled Tread Plate
ASTM B695	Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
SSPS SP-5	White Metal Blast Cleaning

B. Qualifications:

1. Welding: As specified in Section 05050.

### 1.03 SUBMITTALS

A. Procedures: Section 01300.

B. Manufacturer's product data showing conformance to the Specifications.

C. Detailed shop drawings.

D. Ladders:

1. Certification of load and fatigue tests.
2. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
3. Provide templates for anchors and bolts specified for installation under other Sections.
4. Provide reaction loads for each hanger and bracket.

E. Passivation method for stainless steel members.

F. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

G. Welding Data: As specified in Section 05050.

### 1.04 GENERAL

A. Observation of Work: The Project Representative shall have access to any fabrication site or shop for the purpose of observing fabrication of items, structures, equipment, piping, electrical and other components that will be used in or incorporated in the Work.

B. Notifications:

1. Start of Work: Notify the Project Representative in advance of the start of fabrication. For fabrication sites within 50 miles of the Site, provide 48 hours notice. For fabrication sites greater than 50 miles from the Site, provide 14 days notice.

2. Finish Work: Notify the Project Representative in advance of applying finish. For fabrication sites within 50 miles of the Site, provide 48 hours notice. For fabrication sites greater than 50 miles from the Site, provide 14 days notice.

C. The use of salvaged, reprocessed or scrap materials will not be permitted.

## **PART 2 PRODUCTS**

### **2.01 GENERAL (NOT USED)**

### **2.02 MATERIALS**

#### **A. Steel:**

Sheets, plates and shapes	ASTM A36
Pipe	ASTM A53, Grade B, Type E or S
Square/rectangular tubing	ASTM A500, Grade B
Headed Anchor Studs	ASTM A29
Deformed anchor bars	ASTM A496 or A615
Bolts	ASTM A307, Grade B or ASTM F1554, Grade 36
Nuts	ASTM A563
Washers	ASTM F844

#### **B. Stainless Steel:**

Sheets and plates	ASTM A240, Type 316L
Shapes, bars, and similar items	ASTM A479, Type 316L
Pipe	ASTM A312, Type 316L
Headed Anchor Studs	ASTM A276, Type 304L
Bolts	ASTM A193 or A320, Type 316
Nuts	ASTM A194, Type 316
Washers	Type 316

#### **C. Aluminum:**

Sheets and plates	ASTM B209, Type 6061-T6
Bars, flats and similar items	ASTM B211 or B221, Type 6061-T6
Shapes	ASTM B221 or B308, Type 6061-T6
Round tubing and pipe	ASTM 210 or B221, Type 6061-T6
Square and rectangular tubing	Type 6063-T52
Pipe	ASTM B211 or B241, Type 6061-T6*
Bolts	ASTM A193 or A320, Type 316
Nuts	ASTM A194, Type 316
Washers	Type 316

#### **D. Checkered Plate:**

Steel	ASTM A786
Stainless steel	ASTM A793, Type 304
Aluminum	ASTM B632, Type 6061-T6

### **2.03 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES**

A. As specified within Section 05501.

### **2.04 CONCRETE DRILLED ANCHORS**

A. As specified within Section 05501.

## **2.05 WELDED ANCHOR STUDS AND DEFORMED BAR ANCHORS**

- A. Headed anchor studs (HAS) or threaded anchor studs (TAS), as indicated in the Drawings.
  - 1. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semikilled or killed aluminum or silicon dioxiation, unless indicated otherwise.
  - 2. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.
  - 3. Manufacturers:
    - a. Nelson Stud Welding.
    - b. Stud Welding Associates, Inc.
    - c. Approved Equal.
- B. Deformed Bar Anchors (DBA): As manufactured by Nelson Stud Welding, Milton, WA; or Approved Equal.

## **2.06 LIFTING LUGS**

- A. Individual equipment and each field part weighing in excess of 50 pounds: fitted with lifting lugs for easy handling.

## **2.07 PIPE SLEEVES**

- A. ASTM A53/A53M, Schedule 40 steel pipe sleeves with continuously welded 3/16-inch thick seep ring with outside diameter 3 inches greater than sleeve outside diameter. Hot-dip galvanize in accordance with ASTM A123/A123M.

## **2.08 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING**

- A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.
- B. Welded anchors for stainless steel support frames shall also be stainless steel.

## **2.09 SIDEWALK DOORS**

- A. As specified in Section 08310.

## **2.10 FLOOR HATCHES**

- A. As specified in Section 08310.

## **2.11 STEEL PLATE CLADDING (MP-2)**

- A. Fabricate in configurations indicated in the Drawings from 1/8 inch cold rolled steel sheet.
- B. Finish: Provide shop primed units for field finish coating in color indicated in the Drawings and as specified in Section 09900.

## **2.12 PERFORATED METAL SHEET (MP-3)**

- A. Fabricate in configurations indicated in the Drawings from 11 Gauge hot-rolled, pickled and oiled (HRPO) sheet.
- B. 1/4 IN holes on 3/8 IN staggered centers; 40% open area with perimeter margins as indicated in the Drawings.
- C. Finish: Provide shop primed units for field finish coating in color indicated in the Drawings and as specified in Section 09900.

## 2.13 LADDERS

- A. Fabricate pre-engineered ladders with rails, rungs, landings, and cages to meet applicable requirements of OSHA, CFR Part 1910.27, and ANSI A14.3.
  - 1. Concentrated load of 300 pounds plus 30 percent impact on rungs.
  - 2. Maximum rung deflection of  $l/360$ .
  - 3. Concentrated load of 300 pounds plus 30 percent impact between consecutive attachments.
  - 4. Self-closing gates at landings.
- B. Stainless Steel Flat Bar Ladders:
  - 1. Punch rails, pass rungs through rails, and weld on outside.
  - 2. Weld brackets to the ladder for fastening ladder to wall.
- C. Aluminum Pre-Engineered Pipe Ladders:
  - 1. Rungs:
    - a. Aluminum extrusions of Alloy 6063-T6.
    - b. Nonslip grip surface, 1-inch wide flat top, and semicircular bottom with mill finish.
    - c. Diamondback, finish to match rails, as manufactured by Alcoa Building Products, Inc. or Approved Equal.
  - 2. Side Rails: ASTM B429, Alloy 6063-T6, 1-1/2 inches, Schedule 40 pipe with anodized finish, AA M32-C22-A41.
  - 3. Fasteners for Ladder Attachments and Cage Assembly: Stainless steel.
  - 4. Welded, pop riveted, or glued construction is not acceptable.
  - 5. Fabricate to longest length as practical but not to exceed 24 feet.
  - 6. Furnish support attachments to side rails at 6 feet maximum spacing.
  - 7. Manufacturer: Thompson Fabricating Co. Inc. or Approved Equal.
- D. Ladder Safety Post:
  - 1. Telescoping tubular, spring balanced and automatically locking in raised position, with release lever for unlocking.
  - 2. Post: Stainless steel, AISI Type 316.
  - 3. Spring Mechanism: Stainless steel.
  - 4. Furnish dissimilar metal protective coatings at connections.
  - 5. Manufacturer and Product: Bilco Co.; "Ladder Up" to fit ladder rungs; or Approved Equal.
- E. Ship Ladder:
  - 1. Pre-engineered ship ladder designed by ship ladder manufacturer to meet requirements as stated herewithin.
  - 2. Configuration of ship ladder shall be in accordance with the Drawings.
  - 3. Material:
    - a. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
    - b. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.
  - 4. Rungs: 1-1/4-inch deeply serrated square rungs for maximum grip and traction.
  - 5. Railing: Aluminum pipe rail, not less than 1-1/2 inches in diameter with hemispheric end caps.
  - 6. Landing Platform: Deck of serrated aluminum treads.
  - 7. Straight run ship ladder with intermediate landing shall be designed to be self-supporting without intermediate posts or brackets.
  - 8. L-shaped ship ladder shall be designed with intermediate posts. Posts shall be supplied by ship ladder manufacturer.
  - 9. Brackets and connections: As required by ship ladder manufacturer's design.
  - 10. Finish: Mill finish.
  - 11. Fasteners: Stainless steel.
  - 12. Manufacturers:
    - a. O'Keeffe's, Inc. combination of Model 521 and Model 523.
    - b. Approved Equal.

## **2.14 FALL PROTECTION EQUIPMENT**

- A. Fall protection davit base:
  - 1. Floor-mount cast-in-place sleeve davit base.
  - 2. Install flush with concrete floor.
  - 3. Stainless steel.
  - 4. Manufacturers:
    - a. DBI/SALA Model 8512828. No substitutions allowed.

## **2.15 FABRICATED UNITS**

- A. Weir and Baffle Plates: Fabricate plates and associated framing of aluminum alloy 6061-T6 using welding filler wire as manufactured by Alcoa, No. 4043, or Approved Equal, unless indicated in the Drawings.
- B. Slide Gates and Guide Frames:
  - 1. Hand lift stop gate guide as specified in: Not used.
  - 2. Corrosion-resistant slide gates as specified in Section 11101.
- C. Architectural Gates and Frames:
  - 1. Gate and support framing at plastic wall panels specified in Section 07420 and as indicated in the Drawings.
  - 2. Gates and support framing for bar grating gates fences specified in Section 05530 and as indicated in the Drawings.

## **2.16 FASTENERS**

- A. As listed in this Section.
- B. Finish: unless otherwise indicated, steel bolts, screws, nuts, washers and other steel fasteners: mechanically zinc-coated in accordance with ASTM B695, Class 50.
- C. Thread lubricant for stainless steel fasteners:
  - 1. Apply anti-seizing lubricant to the threads prior to making up the connections in accordance with manufacturer's instructions.
  - 2. Lubricant: manufactured and labeled for use with stainless steel and shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc or copper.

## **2.17 ACCESSORIES**

- A. Antiseizing Lubricant for Stainless Steel Threaded Connections:
  - 1. Suitable for potable water supply.
  - 2. Resists washout.
  - 3. Manufacturers and Products:
    - a. Bostik, ; Neverseez.
    - b. Saf-T-Eze Div., STL Corp.; Anti-Seize.
    - c. Approved Equal.
- B. Neoprene Gasket:
  - 1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise indicated in the Drawings.
  - 2. Thickness: Minimum 1/4 inch.
  - 3. Furnish without skin coat.
  - 4. Manufacturer and Product: Rubatex Corporation,; Rubatex No. R-411-N, or Approved Equal.

## **2.18 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION AND PREPARATION**

- A. Verify measurements at the Site and that field conditions are acceptable and are ready to receive work.
- B. Make provisions for erection loads with temporary bracing. Keep work in alignment.
- C. Provide items required to be cast into concrete or embedded in masonry with setting templates.
- D. Welding inspection and nondestructive testing: As specified in Section 05050.

### **3.02 FABRICATION**

- A. General:
  - 1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
  - 2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
  - 3. Conceal fastenings where practical; where exposed, flush countersink.
  - 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
  - 5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
  - 6. Punch holes 1/16-inch larger than the nominal size of the bolts, unless otherwise indicated. Whenever needed because of the thickness of the metal, subpunch and ream or drill holes.
  - 7. Perform fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work prior to hot-dip galvanizing.
  - 8. Fit and assemble in largest practical sections for delivery to Site.
- B. Materials:
  - 1. Use steel shapes, unless otherwise noted.
  - 2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 and 0.25 percent.
  - 3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures – Allowable Stress Design.
- C. Welding:
  - 1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
  - 2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
  - 3. Steel: Meet fabrication requirements of AWS D1.1, Section 5 and Section 05050.
  - 4. Aluminum: Meet requirements of AWS D1.2 and Section 05050.
  - 5. Stainless Steel: Meet requirements of AWS D1.6 and Section 05050.
  - 6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1, Section 7, and manufacturer's instructions.
  - 7. Complete welding before applying finish.
- D. Finish:
  - 1. Unless Otherwise Indicated:
    - a. Steel Items Weighing 100 Pounds or Less: Hot-dip zinc-coated, ASTM A123 or ASTM A153.
    - b. Steel Items Weighing more than 100 Pounds: Coated as indicated in Section 09900.

- c. Stainless Steel: None.
- d. Aluminum: Coated as indicated in Section 09900.
- 2. Painting:
  - a. Shop prime with rust-inhibitive primer as specified in Section 09900, unless otherwise indicated.
  - b. For Finish Schedule see Section 09901.
  - c. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09900, unless indicated otherwise.
  - d. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
- 3. Galvanizing:
  - a. Fabricate steel to be galvanized in accordance with ASTM A143, ASTM A384, and ASTM A385. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
  - b. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385.
  - c. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
  - d. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
  - e. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
  - f. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
  - g. Galvanized steel sheets in accordance with ASTM A653.
  - h. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.
- E. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in contact with sewage. Cover full bearing surfaces.
- F. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.
- G. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

### **3.03 FINISH**

- A. Smooth and uniform weld profiles that comply with referenced welding codes and Section 05050.
- B. Obtain Project Representative's acceptance before applying finish.

### **3.04 INSTALLATION**

- A. Install items plumb, level and square, accurately fitted, and free from distortion or defects.
- B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.



- D. Protect encased or embedded dissimilar metals (both metals shall be encased or embedded) from galvanic corrosion by means of pressure tapes, coatings or isolators.
- E. Place metalwork to be embedded in concrete accurately and hold in correct position while the concrete is placed or, if indicated, form recesses or blockouts in the concrete. Thoroughly clean the surfaces of metalwork in contact with or embedded in concrete. If accepted, recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place.
- F. Seat angles, supports and guides: Set seat angles for grating and supports for floor plates so that they maintain the grating and floor plates flush with the floor.
- G. Pipe Sleeves:
  - 1. Provide a pipe sleeve wherever a pipe or similar item passes through concrete.
  - 2. If not otherwise indicated in the Drawings provide a caulking sealant or a mechanical seal to form a watertight seal of the annular space between pipes and pipe sleeves.

### **3.05 SHIP LADDERS**

- A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
- B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
- C. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

### **3.06 FIELD REPAIR OF COATINGS**

- A. Galvanized:
  - 1. Maximum area to be repaired: no more than 1/2 of 1 percent of the surface area or 36 sq. in. per ton of piece weight, whichever is less. Damage in excess of this requirement: repaired by stripping and recoating entire piece.
  - 2. Clean damaged areas to SSPC-SP5. Repair with zinc-rich paint in accordance with the manufacturer's instructions and with ASTM A780, Annex A2. Minimum thickness requirements: in accordance with ASTM A123, Paragraph 6.2.3.
  - 3. Use zinc-rich repair paint.
  - 4. Acceptable Manufacturers:
    - a. ZRC Galvilite.
    - b. LPS Cold Galvanize.
    - c. Approved Equal.
- B. Painted: after installation, clean and touch up damaged areas of with the same materials used for the shop coat.

### **3.07 ELECTROLYTIC CORROSION PROTECTION**

- A. Coat surfaces of aluminum that are to be in contact with concrete, grout or dissimilar metals as specified in Section 09900.

### **3.08 FIELD QUALITY CONTROL**

- A. Welded Anchor Studs:
  - 1. At start of each production period, perform the following test to determine proper generator, control unit, and stud welding gun settings, in accordance with AWS D1.1, Chapter 7:
    - a. Weld two test studs and visually inspect for full 360-degree flash.

- b. Bend test studs 30 degrees from vertical for headed anchor studs (HAS). Torque test threaded anchor studs (TAS) studs per AWS D1.1, Section 7.6.6.2.
    - c. Test studs will be acceptable if there is no failure of welds.
    - d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.
  - 2. During production, if visual inspection reveals that weld does not exhibit full 360-degree flash or that stud has been repaired by welding, perform the following test in accordance with AWS D1.1, Chapter 7:
    - a. For HAS studs, bend stud approximately 15 degrees from vertical, away from missing portion of flash. For TAS studs, torque test per AWS D1.1, Section 7.6.6.2.
    - b. Studs meeting this test without exhibiting cracks in weld will be considered acceptable and left in bent position.
    - c. Replace studs failing test.
- B. Special inspection, in accordance with Section 01420 and SBC Chapter 17. Special inspection will be provided by the Owner.

### 3.09 MATERIAL SCHEDULE

- A. Unless otherwise indicated in the Drawings, provide material based on area exposure.

Area Exposure	Material	Response
Outdoor	Aluminum	
Indoor, Dry	Hot dip galvanized steel	
Indoor, Wet	Hot dip galvanized steel	
Chemical Corrosive	FRP	
Process Corrosive	FRP	
Head Space	Type 316 stainless steel	
Submerged	Type 316 stainless steel	

### 3.10 FASTENER SCHEDULE

- A. Provide fasteners as follows:

Service Use and Location (Area Exposure)	Product	Remarks
<b>Connections for Structural Steel Framing</b>		
Outdoor Indoor, Wet Indoor, Dry	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members
<b>Connections for Steel Fabrications and Wood Components</b>		
Outdoor Indoor, Wet Indoor, Dry	Hot-dip galvanized carbon steel bolted connections	
Head Space Submerged	Stainless steel bolted connection	
<b>Connections of Aluminum Components</b>		
Head Space Submerged Outdoor Indoor, Wet Indoor, Dry	Stainless steel bolted connections, unless otherwise specified with equipment	

Service Use and Location (Area Exposure)	Product	Remarks
All Others		
Outdoor Indoor, Wet Indoor, Dry Chemical Corrosive Process Corrosive Head Space Submerged	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on all stainless steel threads.

**END OF SECTION**

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## SECTION 05501

### ANCHORAGE TO CONCRETE

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies all anchorage to concrete, complete with washers and nuts.
- B. Concrete anchorage systems indicated in the Drawings, or required to secure the various parts together and provide a complete installation, shall be generally indicated in the Drawings. The tabulation of items herein is not intended to be all inclusive, and it shall be the Contractor's responsibility to provide all metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the Project.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A36	Standard for Carbon Structural Steel
ASTM A153	Standard for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193	Standard for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Standard for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both
ASTM A307	Standard for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A320	Standard for Alloy Steel Bolting Materials for Low Temperature Service
ASTM A563	Standard for Carbon and Alloy Steel Nuts
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B695	Standard for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C881	Standard for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear
ASTM D648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1525	Standard Test Method for Vicat Softening Temperature of Plastics
ASTM F436	Standard Specification for Hardened Steel Washers
ASTM F844	Standard for Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
AC193	Acceptance Criteria for Mechanical Anchors in Concrete Elements
AC308	Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

- B. The diameter and capacity of anchor bolts and concrete anchors shall be as recommended or required by the equipment or machinery manufacturer, including any recommended or required adjustment for seismic conditions listed in Section 01031. In case of conflicting or ambiguous recommendations or requirements, the most stringent shall apply. Verify that the capacities and configurations conform to the Drawings.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Manufacturer's product data.
- C. Manufacturer's information showing the recommended installation equipment and procedures for the following:
  - 1. Drilled-in concrete anchors.
  - 2. Epoxy anchor shall include instructions for the safe handling of epoxy adhesives.
- D. Design calculations and details showing the required diameter, length, embedment, edge distance, confinement, and other conditions, prepared, stamped, dated, and signed by a Professional Civil or Structural Engineer registered in the state of Washington, for all anchor bolts and concrete anchors exceeding the capacities or not conforming to the configurations indicated in the Drawings and as required by Section 01031.

### **1.04 EXPOSURE CONDITIONS**

- A. Dry: indoor spaces not subject to moisture, washdown, hydrogen sulfide gas or chemicals.
- B. Wet and/or corrosive: outdoor areas, or indoor areas subject to moisture, washdown, hydrogen sulfide gas or chemicals.
- C. Submerged: at or below a point 1.5 foot above maximum fluid surface.
- D. Unless otherwise indicated, all non-submerged surfaces shall be considered wet or corrosive.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Unless otherwise specified, materials shall conform to the following:
  - 1. Anchor bolts:
    - a. Carbon steel: ASTM F1554 Grade 36 or Grade 55.
    - b. Stainless steel: ASTM A193 or A320, Type 316.
    - c. Galvanized: ASTM A307, hot-dip zinc coated per ASTM A153, Class C or mechanically coated per ASTM B695, Class 50.
  - 2. Threaded rod:
    - a. Carbon steel: ASTM F1554. Grade 36 or F568M Class 5.8.
    - b. Stainless steel: Type 316, ASTM A193 or A320.
    - c. Galvanized: ASTM A36, hot-dip zinc coated per ASTM A153, Class C or mechanically coated per ASTM B695, Class 50.
  - 3. Nuts:
    - a. Carbon steel: ASTM A194, Grade 2H.
    - b. Stainless steel: Type 316, ASTM F594.
    - c. Galvanized: ASTM A307, hot-dip zinc coated per ASTM A153, Class C or mechanically coated per ASTM B695, Class 50.

4. Washers:
    - a. Carbon steel: ASTM F436.
    - b. Stainless steel: Type 316, ASTM A194.
    - c. Galvanized: ASTM F844, F436, hot-dip zinc coated per ASTM A153, Class C or mechanically coated per ASTM B695, Class 50.
  5. Drilled-in concrete anchors:
    - a. Carbon steel: ASTM F1554. Grade 36 or F568M Class 5.8.
    - b. Stainless steel: Type 316, ASTM F593.
    - c. Galvanized: ASTM A153.
  6. Epoxy concrete anchors:
    - a. Stainless steel: Type 316, ASTM F593.
    - b. Epoxy adhesive: ASTM C881, Type 1, Grade 3, Class A, B or C.
  7. Grouted concrete anchors:
    - a. Stainless steel: Type 316, ASTM A193 or ASTM A320.
    - b. Grout: Non-shrink as specified in Section 03600.
- B. Fasteners: all components of mating fasteners, bolts, nuts and washers, of the same material and coated by the same process.

## 2.02 ANCHOR BOLTS

- A. Unless indicated otherwise in the Drawings, provide 3/4-inch minimum diameter by 12-inch long.
- B. Provide a minimum of two nuts and a washer of the same material for each bolt.
- C. Provide sleeves as indicated in the Drawings for location adjustments.
- D. Provide anchor bolt material for the exposure conditions as noted below:
  1. Equipment and machinery:
    - a. Dry exposure: stainless steel.
    - b. Wet or submerged exposure: stainless steel.
  2. Fabricated metalwork or structural building or frame components:
    - a. Dry Exposure:
      - 1) Steel anchoring: galvanized steel.
      - 2) Other metal anchoring: stainless steel.
    - b. Wet or submerged exposure: stainless steel.
- E. Anchor Bolt Sleeve: high density polyethylene plastic.
  1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
  2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
  3. Material requirements shall conform to the following:
    - a. Plastic: high-density polyethylene.
    - b. Density: ASTM D1505.
    - c. Vicat softening point: ASTM D1525.
    - d. Brittleness Temperature: ASTM D746.
- F. Nonshrink Grout: comply with the requirements of Section 03600.

## 2.03 CONCRETE ANCHORS

- A. Drilled-in concrete anchors:
  1. Drilled-in concrete anchors: Drilled-in concrete anchors (post installed mechanical anchors) shall have an ICC Evaluation Service Report (ESR) indicating compliance with the requirements of SBC 2012 for use in cracked and uncracked concrete for the anchor type and concrete strength conditions for which the anchor will be used. The ESR shall indicate SBC 2012 compliance for

use under seismic loading conditions. The basis of the ESR shall be Acceptance Criteria for Mechanical Anchors in Concrete Elements (AC193).

2. Acceptable Manufacturers:
  - a. Red Head Wedge anchors or Red Head Sleeve anchors by ITT Phillips.
  - b. Kwik-Bolt stud type or HDI Drop-In anchors by Hilti, Inc.
  - c. Wej-It by Wej-It Corporation.
  - d. Parabolt PB anchors by Molly Division of Emhart Corp.
  - e. Approved Equal.

B. Threaded-Rod Anchors:

1. Threaded-rod concrete anchors (post installed adhesive anchors) shall have an ICC Evaluation Service Report (ESR) indicating compliance with the requirements of SBC 2012 for use in cracked and uncracked concrete for the anchor type and concrete strength conditions for which the anchor will be used. The ESR shall indicate SBC 2012 compliance for use under seismic loading conditions. The basis of the ESR shall be Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements (AC308).
2. Anchors shall have allowable working loads not less than those tabulated in the Structural Notes or Details. Provide minimum diameter of 3/8 inch.
3. Do not use where fire or elevated temperatures exceeding 150 degrees F can occur, unless specifically shown otherwise.
4. Anchor Rod: Type 316 stainless steel threaded rod free of grease, oil, or other deleterious material with a 45-degree chisel point.
5. Epoxy Adhesive:
  - a. Meet ASTM C881, Type 1, Grade 3, Class A, B, or C.
  - b. Two-component, 100 percent solids, non-sag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments, and gray in color. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
6. Mixed Epoxy Adhesive: Non-sag paste consistency with ability to remain in a 1-inch diameter overhead drilled hole without runout, holding the following properties:
  - a. Slant Shear Strength, ASTM C881 and ASTM C882, No Failure in Bond Line, Dry/Moist Conditions: 5,000 psi.
  - b. Compressive Strength, ASTM D695: 14,000 psi minimum.
  - c. Tensile Strength, ASTM D695: 4,500 psi.
  - d. Heat Deflection Temperature, ASTM D648: 135 degrees F, minimum.
7. Epoxy Adhesive Packaging:
  - a. Disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio and fit into a manually or pneumatically operated caulking gun.
  - b. Dispense components through a mixing nozzle that thoroughly mixes components and places epoxy at base of predrilled hole.
  - c. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate sizes of anchor rods.
  - d. Cartridge Markings: Include manufacturer's name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
8. Storage of Epoxy adhesive:
  - a. Store epoxy cartridges on pallets or shelving in a covered storage area.
  - b. Control temperature above 60 degrees F and dispose of cartridges if shelf life has expired. If stored at temperatures below 60 degrees F, test adhesive prior to use to determine if adhesive meets specified requirements.
9. Acceptable manufacturers:
  - a. Hilti, Inc.
  - b. Simpson Strong-Tie, Inc.
  - c. Approved Equal.



- C. Grouted concrete anchors shall be stainless steel threaded rod, anchored in a predrilled hole with non-shrink grout complying with the requirements of Section 03600. Submit specific use and design calculations for review and approval by the Project Representative. Loads shall not exceed values indicated in the Drawings.
- D. Provide concrete anchors for the exposure conditions as noted below:
  - 1. Drilled-in Concrete Anchors.
    - a. Dry exposure: galvanized steel.
    - b. Wet exposure: stainless steel.
    - c. Submerged exposure: do not use drilled-in concrete anchors for submerged exposure.
  - 2. Epoxy Anchors:
    - a. Dry exposure: stainless steel.
    - b. Wet or submerged exposure: stainless steel.
    - c. Epoxy anchors shall not be used in any overhead applications.
  - 3. Grouted concrete anchors:
    - a. Dry exposure: stainless steel.
    - b. Wet or submerged exposure: stainless steel.
    - c. Chlorine gas and off-gassing exposure: coated stainless steel.
- E. Coated concrete anchors shall be coated by fusion bonding. Coating of threads is not required. Where threads are covered with a fusion bonded coating, provide the nut of proper size to fit and provide a connection of equal strength to the embedded anchor.

## **2.04 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)**

- A. Where stainless steel nuts and threaded fasteners are used, apply anti-seizing lubricant to the threads prior to making up the connections. Lubricant shall be manufactured and labeled for use with stainless steel and shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Install per manufacturer's recommendations.
- B. All machinery or equipment with moving parts and all structural steel shall be anchored using grouted or cast-in-place anchor bolts.
- C. Drilled-in epoxy or expansion anchors: not permitted unless specified.
- D. Drilled-in epoxy or expansion anchors: not permitted for permanent overhead attachment in an application subject to tension or withdrawal forces. Through bolts are required for existing concrete or cast in place bolts with embedded anchoring plate for new construction.
- E. Cutting and welding: not permitted.
- F. After anchors have been embedded, protect threads with grease or anti-seizing lubricant and install the nuts.
- G. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators.
- H. Provide beveled washers where mating surface is not square with the anchor bolt.

### **3.02 ANCHOR BOLT HOLES IN EQUIPMENT**

- A. Shall not exceed the bolt diameters by more than:
  - 1. Bolts smaller than 1-inch: 25 percent.
  - 2. Bolts 1-inch and larger: 1/4-inch.

### **3.03 ANCHOR BOLTS**

- A. Place anchor bolts to be embedded-in concrete accurately and hold in correct position while the concrete is placed or, if specified, form recesses or blockouts in the concrete and grout the metalwork in place in accordance with Section 03600.
- B. Thoroughly clean the surfaces of metalwork in contact with concrete.
- C. Anchor bolts shall have sufficient exposed length for leveling the machinery while maintaining a minimum of 1/2-inch clearance between the baseplate and the foundation.
- D. The annular space around the anchor bolt below the foundation surface and the machinery baseplate shall be filled with non-shrink grout in accordance with Section 03600. Completely fill all voids. The anchor bolt leveling nuts shall be blocked out of the grout.
- E. After the grout has attained its designed strength, the anchor bolt leveling nuts shall be backed off and the grout patched after the primary anchor bolt nuts are tightened.

### **3.04 DRILLED-IN CONCRETE ANCHORS**

- A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength.
- B. Install in strict conformance with manufacturer's written instructions.
- C. Use manufacturer's recommended drills and equipment.
- D. Unless otherwise specified, embedded length shall not include housekeeping pads or fill grout.
- E. Epoxy anchors shall not be installed when the temperature of the concrete is below 35 degrees F or above 110 degrees F.
- F. Furnish manufacturer's representative, for each type of concrete anchor used, to the jobsite to conduct jobsite training for proper installation, handling, and storage of each anchor system for personnel as required. Notify Project Representative of training session schedule.
- G. Unless specifically indicated in the Drawings, flush mounted concrete anchors shall not be used.

### **3.05 GALVANIZING REPAIR**

- A. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired in accordance with the recommendations of ASTM A780 as required by the Project Representative.

**END OF SECTION**

## SECTION 05520

### METAL RAILING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies prefabricated aluminum guards and handrails and fabricated painted steel guards and handrails.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those in the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AA	45, Designation System for Aluminum Finishes
ANSI	SS306, Stainless Steel for Building Exterior
ASTM A36/A36M	Standard Specification for Structural Steel
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A320	Specification for Alloy/Steel Bolting Materials for Low-Temperature Service
ASTM A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM B241	Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM E985	Standard Specification for Permanent Metal Railing Systems and Rails for Buildings
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code – Aluminum
SBC	Seattle Building Code
ICC	International Code Council
OSHA	29 CFR 1910, Code of Federal Regulations
SSPC	Steel Structures Painting Council

- B. Regulatory requirements: Handrailing shall meet the requirements of the standards of the Occupational Safety and Health Administration, the Division of Industrial Safety and Health of the State of Washington, and the Seattle Building Code (SBC), WAC 296-24.
- C. Qualifications: Calculations required for design data prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.
- D. Welding Procedures and Welder Qualifications: As specified in Section 05050.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Certified Test Reports: Before fabrication of handrailing, provide certificates which attest to their material complying with this Section.
- C. Shop drawings:
  - 1. Indicate handrail profiles, sizes, connections, anchorage, size and type of fasteners, and accessories. Project-specific scale plans and elevations of handrails.
  - 2. Manufacturer's literature and catalog data of handrail and components.
- D. Design Data: Calculations or test data using design performance loads and include the following:
  - a. Bending stress in, and deflection of, posts in accordance with ASTM E985.
  - b. Stress in post base connection.
  - c. Calculation of anchorage forces and comparison of these forces to ICC Seattle Building Code recommendations regarding safe allowable design loads of anchorages.
  - d. For concrete anchor spacings less than 12 anchor diameters and edge distances less than six anchor diameters, make reduction in allowable pullout and shear values. Use published ICC Report values for anchors without Special Inspection; or provide independent laboratory inspection service for ICC Report values with Special Inspection.
  - e. Design data shall be prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.
- E. Samples:
  - 1. Railing sections, 6 inches long showing different connections and proposed finish.
  - 2. Each fitting including wall brackets, castings, toeboard fittings, and rail expansion joints.
- F. Manufacturer's assembly and installation instructions.
- G. Special Inspection:
  - 1. Manufacturer's instructions for Special Inspection of concrete anchors.
  - 2. Special Inspection report as specified within this Section.
- H. Manufacturer's Certificate of Proper Installation.
- I. Manufacturer's written recommendations describing procedures for maintaining handrails including cleaning materials, application methods, and precautions to be taken in the use of cleaning materials.
- J. Test Reports: Test data may supplement load calculations providing data covers the complete handrail system, including anchorage:
  - 1. Test data for handrail and components showing load and deflection due to load, in enough detail to prove handrail is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
    - a. Railing and post connections.
    - b. Railing wall connections.
    - c. Post and base connections.
    - d. Railing expansion joint connections.
    - e. Railing gate assembly, including latch and gate stop. Both gate latch and stop to support required loads applied, independent of each other.
    - f. Railing gate hinges.
    - g. Railing picket panel clamps and connections.
  - 2. Deflection Criteria: In accordance with ASTM E985 and design loads specified.
  - 3. Aluminum Rail Piping: Test data showing yield strength of pipe as-delivered equals or exceeds values specified in this Section.

4. Concrete Anchors: Calculations and test data for review prior to use, on anchors other than those specified.

#### **1.04 DEFINITIONS**

- A. Handrails: Synonymous with terms; i.e., guard system, guardrail system, railing system, ramp-rail system, and stair-rail system. Handrails are comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.
- B. Toeboards: Vertical barrier at floor level usually erected on handrails along exposed edges of floor or wall openings, platforms, ramps, or stairs to prevent miscellaneous items from falling through.
- C. ICC Reports: Evaluation Reports published by ICC for concrete anchor manufacturers.
- D. Special Inspection: As governed by the ICC SBC.

#### **1.05 PERFORMANCE REQUIREMENTS**

- A. General: Design, test, fabricate, and install railing assembly and attachments to meet SBC 2012, structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in each of the respective components comprising handrails.
- B. Top Rail and Guard Posts of Handrails: Capable of withstanding the following load cases applied:
  1. Concentrated load of 200 pounds applied at any point along the top rail and in any direction in accordance with ICC SBC. Transfer this load through the supports to the structure.
  2. Uniform load on the top rail of 50 pounds per linear foot applied in any direction in accordance with ICC SBC. Transfer this load through the supports to the structure.
  3. Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC SBC.
- C. In-Fill Area and Mid-Rail of Railing Systems:
  1. Capable of withstanding horizontal concentrated load of 50 pounds applied to 1 square foot including openings and space between rails. Apply load at any point in the system including panels, intermediate rails, balusters, or other elements composing in-fill area.
  2. Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of handrails.
- D. Concrete Anchors for Handrail Wall Brackets: Not to exceed ICC SBC allowable loads for actual spacing, edge distance, and embedment, with assumed concrete strength of 4,000 psi.
- E. Concrete Anchors: In accordance with ICC SBC allowable load values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Cushion wrap complete rails, modules and components to prevent scratching and denting during shipment, storage, and installation. Leave wrap intact, insofar as possible, until railing is completely installed.

## **1.07 FIELD MEASUREMENTS**

- A. Verify that field measurements are after construction of facilities and are included in shop drawing submittal. Field verification of dimensions is a prerequisite for fabrication of railing and any misfitting of railing will be the responsibility of the Contractor to rectify until railing complies with the Specifications.

## **1.08 ENVIRONMENTAL REQUIREMENTS**

- A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of handrails to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.
  - 1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Unless otherwise indicated, handrails and guardrails shall be aluminum.
- B. Provide toeboards at guardrails except where concrete curbs are indicated.
- C. System shall accommodate field cutting of posts to fit, prior to installation or attachment to base connections.

### **2.02 RAILING SYSTEMS**

- A. Aluminum Railing System:
  - 1. General:
    - a. Furnish pre-engineered and prefabricated handrailing as indicated in the Drawings.
    - b. Pop rivets and glued railing construction not permitted.
  - 2. Acceptable Manufacturer:
    - a. Connectorail: Julius Blum and Company, Inc.
    - b. Tufrail: Thompson Fabricating Co.
    - c. Westrail II: Moultrie Manufacturing Co.
    - d. Approved Equal.
  - 3. Materials:
    - a. Rails and Posts: 1-1/2 inches nominal, ASTM B241, Alloy 6061-T6 or 6063-T6, minimum tensile strength of 38,000 psi and minimum yield strength of 35,000 psi.
      - 1) Rails: 1.900-inch outside diameter by 0.145-inch wall thickness, Schedule 40.
      - 2) Posts: 1.900-inch outside diameter by 0.200-inch wall thickness, Schedule 80.
      - 3) Solid dowel interconnectors of 6105-T5 or 6061-T6 aluminum.
    - b. Fittings:
      - 1) Cast aluminum elbows, T-shapes, wall brackets, escutcheons.
      - 2) Cast Al-mag with sufficient strength to meet load and test requirements.
      - 3) Anodizable grade finish with excellent resistance to corrosion when subject to exposure of sodium chloride solution intermittent spray and immersion.
      - 4) Handrail and Post Fittings: Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements. Fittings shall match color of pipe in handrails. Sand cast parts not permitted.

- 5) Concrete Top Mount Post Base:
  - a) Four holes in base for concrete anchors. For narrow walls or curbs, furnish two holes in base for concrete anchors with required edge distance.
  - b) Manufacturers and Products:
    - (1) Thompson Fabricating Co.; Part No. TBF-3.4 and Part No. TBF-3.2 for narrow walls and curbs.
    - (2) Moultrie Manufacturing Co.; Part No. WII4HB and WII2HB for narrow walls and curbs.
    - (3) Approved Equal.
- 6) Concrete Side Mounted Handrail Bracket: Extruded aluminum, Alloy 6063-T6 with four holes for bolts or concrete anchors.
  - a) Manufacturers and Products:
    - (1) Thompson Fabricating Co.; Part No. TSM-1.5.
    - (2) Moultrie Manufacturing Co.; Part No. WIISMB.
    - (3) Approved Equal.
- 7) Concrete Anchors for Securing Bases and Brackets to Concrete: Type 304 or Type 316 stainless steel 1/2-inch concrete anchors.
- 8) Handrail Connections for Metal Stairway Stringers:
  - a) Extruded aluminum bracket, Alloy 6063-T6.
  - b) Brackets bolts 1/2-inch diameter Type 304 or Type 316 stainless steel bolts.
  - c) Offset Adjustable Stair Fitting:
    - (1) Thompson Fabricating Co.; Part No. ASF of cast Al-mag.
    - (2) Moultrie Manufacturing Co.; Standard and custom elbow angles, Part No. W51XXX (numbers vary based on angle).
    - (3) Approved Equal.
  - d) Base Connection:
    - (1) Manufacturers and Products:
      - (a) Thompson Fabricating Co.; Part Nos. SMB-2 or SMB-3, ASF, APF.
      - (b) Moultrie Manufacturing Co.; Part No. WIISMBEXT.
      - (c) Approved Equal.
- 9) Handrail Connections for Metal Beams:
  - a) Extruded aluminum bracket, Alloy 6063-T6.
  - b) Bracket bolts 1/2-inch diameter Type 304 stainless steel bolts.
  - c) Manufacturers and Products:
    - (1) Thompson Fabricating Co.; Part Nos. SMB-2 or SMB-3. Use Part No. TSM-1.5 if bracket is attached to flat side of channel.
    - (2) Moultrie Manufacturing Co.; Part No. WIISMBEXT. Use Part No. WIISMB if bracket is attached to flat side of channel.
    - (3) Approved Equal.
- 10) Handrail Wall Brackets: Adjustable wall fitting, with provision for three 3/8-inch Type 304 stainless steel bolts or concrete anchors.
  - a) Manufacturers and Products:
    - (1) Thompson Fabricating Co.; Part No. AWF cast Al-mag aluminum bracket.
    - (2) Moultrie Manufacturing Co.; Part No. W41100.
    - (3) Approved Equal.
- 11) Handrail Gate: 6063-T6, 6105-T5, or 6061-T6 extruded aluminum.
  - a) Hardware Manufacturers and Products:
    - (1) Julius Blum & Co., Inc.; No. 782/3 gate hinges with springs, and No. 784 gate latch and stop.
    - (2) CraneVeyor Corp.; No. C4370b gate hinges with spring, No. C4369 gate latch, and No. C4368 gate stop.
    - (3) Thompson Fabricating Co.
    - (4) Moultrie Manufacturing Co.; Part No. W60006.
    - (5) Approved Equal.

- c. Splice Connectors: Aluminum concealed spigot.
  - d. Toeboards and Accessories: Molded or extruded 6063 or 6061 aluminum.
  - e. Bolts, Nuts, Washers: ASTM A320, Type 304 or Type 316 stainless steel.
  - 4. Finishes: Clear anodized in accordance with the Aluminum Association AA-M32-C22-A41. Anodize exposed prefabricated components, except stainless steel fasteners, after fabrication.
- B. Painted Steel Railing System:
- 1. Pipe: Carbon steel, ASTM A53/A53M, Type E or S, Grade B; or ASTM A501, 1-1/2-inch NPS with 1.900-inch outside diameter and a minimum 0.145-inch wall thickness for rails and a minimum of 0.200-inch wall thickness for posts.
  - 2. Fittings:
    - a. Anchor Bolts and Fasteners: Stainless steel.
    - b. Handrail Post Bolted Baseplate Connector: Baseplate, carbon steel ASTM A36/A36M.
      - 1) Insert: Minimum wall thickness of 0.200 inch or from solid rod in accordance with ASTM A36/A36M.
    - c. Handrail Wall Brackets: Malleable iron, round top, and galvanized.
      - 1) Manufacturers and Products:
        - a) R & B Wagner; No. 1765.
        - b) Julius Blum; No. 1382.
        - c) Approved Equal.
    - d. Handrail Gate: As specified for painted steel piping.
      - 1) Gate Hardware Manufacturers and Products: Type 304 stainless steel:
        - a) Julius Blum & Co., Inc.; Connectorail System, No. 782/3 gate hinges with spring, and No. 784 gate latch and stop.
        - b) Craneveyor Corp.; No. C4370b gate hinges with spring, No. C4369 gate latch, and No. C4368 gate stop.
        - c) Approved Equal.
    - e. Toeboards and Accessories: ASTM A36/A36M steel.
  - 3. Bolts, Nuts, Washers: ASTM A320, Type 304 or Type 316 stainless steel.

## 2.03 ANCHORAGE TO CONCRETE

- A. In accordance with Section 05501.

## 2.04 FABRICATION

- A. General:
  - 1. Fit and assemble components in largest practical sizes, for delivery to the Site.
  - 2. Pipe cuts shall be clean, straight, square, and accurate for minimum joint gap. Perform work in conformance with the handrail manufacturer's instructions. Work shall be free from blemishes, defects, and misfits that can affect durability, strength, or appearance.
  - 3. Unless otherwise indicated, punch holes 1/16-inch larger than the nominal size of the bolts. Whenever needed because of the thickness of the metal, subpunch and ream or drill holes. Replace pieces with mismatched holes. No drifting of bolts nor enlargement of holes will be allowed to correct misalignment.
  - 4. Unless otherwise indicated, supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.
  - 5. 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.
  - 6. Steel handrail welding:
    - a. In accordance with Section 05050.
    - b. Thoroughly fuse without undercutting or overlap.
    - c. Remove splatter, grind exposed welds to blend, and contour surfaces to match those adjacent.
    - d. Grind welds prior to painting of railing sections.



7. Cover exposed ends of steel pipe by welding 1/8-inch minimum thickness steel plate in place or use prefabricated fittings.
8. Form and assemble steel joints exposed to weather to prevent water and moisture from penetrating.

## **2.05 FASTENERS**

- A. Locknuts, Washers, and Screws:
  1. Elastic Locknuts, Steel Flat Washers, RHMS Round Head Machine Screws: Type A 304 or Type A 316 stainless steel.
  2. Flat Washers: Molded nylon.
  3. Manufacturer: McMaster-Carr Supply Co. or Approved Equal.
- B. Bolts and Nuts for Bolting Handrail to Metal Beams: ASTM A193/A193M and ASTM A194/A194M, Type A 316 stainless steel with minimum yield strength for bolts of 95,000 psi, unless otherwise shown.
- C. Pop rivets are not permitted.

## **2.06 SHOP/FACTORY FINISHING**

- A. Aluminum Handrail:
  1. Use same alloy for uniform appearance throughout fabrication for railings.
  2. Handrail and Post Fittings: Match fittings with color of pipe in handrail.
  3. Sand cast parts not permitted.
- B. Steel Handrail:
  1. Coat metal surfaces as specified in Section 09900.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on the actual structure. Install railing with a base that provides plus or minus 1/4-inch vertical adjustment inside the base fitting. If adjustment is required in the field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.
- B. Field fabrication of aluminum railing systems not permitted.
- C. Modification to structure not permitted where handrail is attached.
- D. Mount handrails only on completed walls. Do not support handrails temporarily by means not satisfying structural performance requirements.

### **3.02 EXAMINATION**

- A. Verify measurements at the Site.
- B. Verify that field conditions are acceptable and are ready to receive work.

### **3.03 PREPARATION**

- A. Supply items required to be cast into concrete or embedded in masonry with setting templates.

### 3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Protection from Entrapped Water:
  - 1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
  - 2. Posts mounted in concrete, bends and elbows occurring at low points, drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in the plane of the rail.
- C. Expansion Joints:
  - 1. Maximum intervals of 54 feet on center and at structural joints.
  - 2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
  - 3. Fasten to one side using 3/16-inch diameter set-screw. Place set-screw at bottom of pipe.
  - 4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.
- D. Setting Posts:
  - 1. Surface Mounted:
    - a. Bolt post baseplate connectors firmly in place.
    - b. Shims, wedges, grout, and similar devices for handrail post alignment not permitted.
- E. Handrail Wall Brackets:
  - 1. Support wall rails on brackets spaced maximum 5 feet as measured on the horizontal projection.
  - 2. Install wall anchor backplates on solid blocking in stud walls.
- F. Toeboard:
  - 1. Provide at all handrails except where 4-inch or higher concrete curbs are installed or at gates.
  - 2. Accurately measure in field for correct length, after handrail post installation, cut and secure to posts.
  - 3. Dimension between bottom of toeboard and walking surface not to exceed 1/4 inch.
  - 4. Aluminum Toeboards: Provide expansion and contraction connections between each post.
- G. Railing Gate: Install in accordance with manufacturer's installation instructions.
- H. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings, or isolators.
- I. Protect aluminum in contact with concrete or grout with a heavy coat of bituminous paint in accordance with Section 09900.
- J. Install components plumb and level, accurately fitted, free from distortion or defects.
- K. Place metal to be embedded in concrete accurately and hold in correct position while the concrete is placed or, if specified, form recesses or blockouts in the concrete and grout the metalwork in place after concrete has attained its design strength in accordance with Section 03600. Thoroughly clean the surfaces of metalwork in contact with or embedded in concrete.
- L. Unless otherwise indicated, no field welding of handrails shall be permitted. Where field welding is specified, grind, weld smooth to match adjacent pipe and coat.

### 3.05 TOLERANCES

- A. Set posts plumb and aligned to within 1/8 inch in 12 feet.

- B. Set rails horizontal or parallel to slope of steps to within 1/8 inch in 12 feet.
- C. Install posts and rails in same plane. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
- D. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

### **3.06 FIELD QUALITY CONTROL**

- A. Special Inspection: Special inspection for anchors will be provided by the County where ICC Reports requires special inspection for anchor strength value used.

### **3.07 MANUFACTURER'S SERVICES**

- A. Provide manufacturer's representative at site for aluminum railing system.
- B. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
- C. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.

### **3.08 CLEANING**

- A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.
- B. Do not use acid solution, steel wool, or other harsh abrasive.
- C. If stain remains after washing, restore in accordance with manufacturer's recommendations, or replace stained handrails.

**END OF SECTION**

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## SECTION 05530

### GRATINGS, FLOOR PLATES, AND STAIR TREADS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies floor grating, floor plates, and stair treads.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AISC	Manual of Steel Construction
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A569/A569M	Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality
ASTM A786/786M	Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A793	Standard Specification for Rolled Floor Plate, Stainless Steel
ASTM B210	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B308	Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B632/B632M	Standard Specification for Aluminum-Alloy Rolled Tread Plate
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code – Aluminum
NAAMM ANSI MBG 531	Metal Bar Grating Manual
NAAMM ANSI MBG 532	Heavy-Duty Metal Bar Grating Manual

- B. Qualifications:
1. Design gratings and plates under direct supervision of a professional engineer experienced in structural design of this work with at least 5 years of experience and professionally licensed in the state of Washington.
  2. Welding Procedures and Qualifications: As specified in Section 05050.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Certified test reports: Before fabrication of floor grating, floor plates, or stair treads, provide certificates which attest that all material complies with this Section.
- C. Shop drawings:
1. Include a layout drawing, appropriate sections, location of connections to adjacent grating and supports, and installation details for each item provided.

2. Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
3. Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
4. Catalog information and catalog cuts.
5. Manufacturer's specifications, to include coatings.

D. Samples: Color samples of abrasive stair nosing.

E. Special handling and storage requirements.

F. Installation instructions.

#### **1.04 FIELD MEASUREMENTS**

A. Shop drawing shall indicate field verified measurements only.

#### **1.05 PREPARATION FOR SHIPMENT**

A. Insofar as is practical, factory assemble items provided.

B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

A. Aluminum Grating Bearing Bars: ASTM B221, alloy 6061-T6.

B. Aluminum Grating Cross Bars: ASTM B221 (extrusions) or B210 (drawn).

C. Steel Grating Bearing Bars and Cross Bars: Welding quality mild carbon steel. Comply with ASTM A1011.

D. Accessories: Fasteners and perimeter closure shall match grating material.

E. Safety Stair Treads:

1. Unless otherwise indicated in the Drawings, furnish flush type abrasive nosings on concrete stairs. Do not provide abrasive nosing for metal pan stairs.
2. Nosing Components:
  - a. Homogeneous epoxy abrasive, with minimum 50 percent aluminum oxide content, formed and cured upon an extruded aluminum base.
  - b. Epoxy abrasive shall extend over and form curved front edge of nosing.
  - c. Base of Nosing: Extruded aluminum alloy, 6063-T5, heat-treated.
3. Anchoring System: Double-set anchors consisting of two rows of integrally extruded anchors.
4. Color: Selected by Project Representative from manufacturer's standard color range.
5. 4 inches wide; Alumogrit, Type 101.
6. Acceptable Manufacturers:
  - a. Wooster Products.
  - b. American Safety Tread Co., Inc.; Alumacast.
  - c. Safe-T-Metal Co., Inc.; Style AX.
  - d. Approved Equal.

- F. Floor Plate and Cover Plates:
  - 1. Galvanized Steel: Carbon steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 2. Stainless Steel: ASTM A793, AISI Type 304.
  - 3. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

## 2.02 FABRICATION

- A. Fabricate grates and plates to sizes indicated in the Drawings and to accommodate design criteria.
- B. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
- C. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
- D. Minimum Bearing: ANSI/NAAMM MBG 531.
- E. Grind smooth rough weld beads and sharp metal edges on gratings and plates. Welds exposed to view shall be uniform and neat. Sand blast welds to be galvanized prior to galvanizing.
- F. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
- G. Conceal fastenings where practical.
- H. Drill metalwork and countersink holes as required for attaching hardware or other materials.
- I. Weld Connections: Not permitted on grating except at banding bars.
- J. Unless otherwise indicated, punch holes 1/16-inch larger than the nominal size of the bolts. Whenever needed as a result of the thickness of the metal, subpunch and ream or drill holes.
- K. Perform cutting, drilling, punching, threading, and tapping prior to hot-dip galvanizing.
- L. Grating:
  - 1. Both bearing bars and cross bars shall be continuous.
  - 2. Band openings with bars having the same dimensions as the bearing bars.
  - 3. Band perimeter edges with (3/16-inch) bars flush at the top surface of the grating and 1/4-inch clear of the bottom surface.
  - 4. Weld bars terminating against edge bars to the edge bars when welded construction is used.
  - 5. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16-inch and shall be peened or ground to a smooth surface.
  - 6. Unless otherwise indicated, no single piece of grating shall weigh more than 80 pounds.
  - 7. Serrated surfaces as indicated in the Drawings.
  - 8. Foot and Light Duty Traffic:
    - a. Design Criteria for Foot Traffic Grating:
      - 1) Uniform Service Live Load: 100 psf minimum, unless otherwise shown.
      - 2) Maximum Deflection: 1/4 inch, unless otherwise shown.
      - 3) Banding: 3/16 inch minimum.
      - 4) Thickness of grating as indicated in the Drawings.
    - b. Design Criteria for Light Duty Traffic Grating:
      - 1) Uniform Service Live Load: 300 psf minimum.
      - 2) Maximum Deflection: 1/4 inch.
      - 3) Banding: 1/4 inch.

- 4) Thickness of grating as indicated in the Drawings.
- c. Aluminum Grating:
  - 1) Unless otherwise indicated, punch bearing bars to receive the cross bars fabricated of aluminum.
  - 2) After insertion in the bearing bars, deform cross bars by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings.
  - 3) Fabrication methods employing bending or notching of cross bars will not be permitted.
  - 4) Space bearing bars at 1-3/16 inches center-to-center. For ADA compliant grating, provide bearing bar spacing at 11/16 inch center-to-center.
  - 5) Minimum Bearing Bar Thickness for Rectangular Bar Type Grating: 3/16 inch.
  - 6) Cross Bar Spacing: 4 inches, except use 2-inch cross bar spacing if span is 12 inches or less.
  - 7) Acceptable Manufacturers:
    - a) Swage locked aluminum grating, rectangular bar type, as manufactured by:
      - (1) IKG Industries; Type BS or Type FS. For ADA compliant grating, use Type SCM4 or SCMF4.
      - (2) Seidelhuber Metal Products Inc; Type 19S4 or 19S2. For ADA compliant grating, use Type 11S4 or 11S2.
      - (3) Ohio Gratings, Inc.; Aluminum Flush Top, Type 19-SGF-4 or 19-SGF-2. For ADA compliant grating, use Type 11-SGF-4 or 11-SGF-2.
      - (4) Approved Equal.
    - b) Swage locked aluminum I-bar grating, as manufactured by:
      - (1) IKG Industries; Type IB or IF. For ADA compliant grating, use Type 1CM4 or 1CMF4.
      - (2) Seidelhuber Metal Products, Inc.; Type 19SI4 or 19SI2. For ADA compliant grating, use Type 11SI4 or 11SI2.
      - (3) Ohio Gratings, Inc.; Type 19-SGI-4 or 19-SGI-2. For ADA compliant grating, use Type 11-SGI-4 or 11-SGI-2.
      - (4) Approved Equal.
- d. Steel Grating:
  - 1) Use only where specified.
  - 2) Hot-dip galvanized.
  - 3) Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.
  - 4) Space bearing bars at 1-3/16 inches center-to-center.
  - 5) Minimum Bearing Bar Thickness: 3/16 inch.
  - 6) Cross Bar Spacing: 4 inches, except use 2-inch cross bar spacing if span is 12 inches or less.
  - 7) Acceptable Manufacturers:
    - a) Welded rectangular cross bar design, as manufactured by:
      - (1) IKG Industries; Type WB or WF.
      - (2) Ohio Gratings, Inc.; Light-Duty Welded Steel, Type 19-W-4 or 19-W-2.
      - (3) Grating Pacific, Inc.; Type W-19-4 or W-19-2.
      - (4) Approved Equal.
9. Heavy Vehicular Traffic Grating:
  - a. Design Criteria for Heavy Vehicular Traffic Grating:
    - 1) Loading: AASHTO HS 20-44 and 2-1/2-ton forklift.
    - 2) Banding: 1/4 inch.
    - 3) Thickness of grating as indicated in the Drawings.
  - b. Heavy-Duty Welded Steel Bar Type:
    - 1) Heavy-duty, main bars spaced at 1-7/8 inches maximum center-to-center, except use 1-3/16-inch spacing if span is less than 12 inches.
    - 2) Bearing bar thickness as indicated in the Drawings.
    - 3) Cross Bar Spacing: 4 inches except use 2-inch cross bar spacing if span is 12 inches or less.



- 4) After Fabrication: ASTM A123, zinc coating.
  - 5) Acceptable Manufacturers:
    - a) IKG Industries; Heavy-Weld Style HW.
    - b) Ohio Gratings; Heavy-Duty Welded Steel Grating, W Series.
    - c) Grating Pacific, Inc.:Welded Heavy-Duty Type W.
    - d) Approved Equal.
10. Architectural Gratings
- a. Use only where specified.
  - b. Hot-dip galvanized.
  - c. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.
  - d. Spacing
    - 1) BG-1:
      - a) Space bearing bars at 1-3/16 inches center-to-center.
      - b) Minimum Bearing Bar Thickness: 3/16 inch.
      - c) Bearing Bar Depth: 1 inch.
      - d) Cross Bar Spacing: 4 inches, except use 2-inch cross bar spacing if span is 12 inches or less.
      - e) Smooth top surface.
    - 2) BG-2:
      - a) Space bearing bars at 1-3/16 inches center-to-center.
      - b) Minimum Bearing Bar Thickness: 3/16 inch.
      - c) Bearing Bar Depth: 2 inch.
      - d) Cross Bar Spacing: 4 inches, except use 2-inch cross bar spacing if span is 12 inches or less.
      - e) Smooth top surface.
    - 3) BG-3:
      - a) Space bearing bars at 7/16 inches center-to-center.
      - b) Minimum Bearing Bar Thickness: 3/16 inch.
      - c) Bearing Bar Depth: 1 inch.
      - d) Cross Bar Spacing: 4 inches, except use 2-inch cross bar spacing if span is 12 inches or less.
      - e) Serrated non-slip top surface.
  - e. Acceptable Manufacturers:
    - 1) Welded rectangular cross bar design, as manufactured by:
      - a) IKG Industries.
      - b) Ohio Gratings, Inc.
      - c) Grating Pacific, Inc.
      - d) Approved Equal.

M. Stair Treads:

1. Design Criteria for Stair Treads:
  - a. Service Live Load: 100 psf or 300 pounds distributed over an area of 4 square inches, whichever produces higher stresses.
  - b. Maximum Deflection: 1/4 inch.
  - c. Banding: 3/16 inch minimum.
2. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface. Use ADA compliant grating where indicated in the Drawings.
3. Skid-Resistant Surface: Aluminum oxide grit, epoxy bonded to the entire tread surface in accordance with manufacturer's recommendation.
4. Nosings: Integral ribbing and serrated edge on one long axis of tread or nonslip, abrasive on each tread along one long edge.
5. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.
6. Manufacturers: Same as for grating.

- N. Maximum Width and Weight of Grating Section:
  - 1. Foot Traffic Grating: Any single grating section shall be not less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 80 pounds.
  - 2. Light Duty Traffic Grating: Any single grating section shall not be less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 80 pounds.
  - 3. Heavy Vehicular Traffic Grating: Minimum width of grating sections shall be 2 feet 0 inch regardless of length and weight.
- O. Floor and Cover Plates (Checkered Plate):
  - 1. Alcoa C-102 aluminum tread plate, Reynolds diamond tread plate, or Approved Equal.
  - 2. Hinged cover plates shall be as specified and set flush with surrounding floor.
  - 3. Unless otherwise indicated, no single piece of floor and cover plates shall weigh more than 80 pounds.

## **2.03 FINISHES**

- A. Unless otherwise indicated, steel shall be galvanized.
- B. Where paint finish is noted, refer to Section 09900 for materials and application.

## **2.04 DESIGN CRITERIA**

- A. As specified within this Section.

## **2.05 FLOOR PLATE**

- A. Minimum Thickness:
  - 1. Steel: 1/4 inch, unless otherwise indicated in the Drawings.
  - 2. Aluminum: 3/8 inch, unless otherwise indicated in the Drawings.
- B. Surface shall be raised-lug pattern (steel) or diamond tread (aluminum), unless otherwise indicated in the Drawings.
- C. Slip-Resistant Surface:
  - 1. Provide where indicated in the Drawings.
  - 2. Acceptable Manufacturers:
    - a. IKG Industries; Mebac.
    - b. W.S. Molnar Co.; Slip-Not Grade 2-Medium.
    - c. Approved Equal.

## **2.06 EXTRUDED FLOOR PLATE (NOT USED)**

## **2.07 ACCESSORIES**

- A. Anchor Bolts, Nuts, and Washers: In accordance with Section 05501.
- B. Removable Fastener Clips and Bolts:
  - 1. Removable from above grating walkway surface.
  - 2. Hat Bracket: Type 304 stainless steel.
  - 3. Bolt: Type 316 stainless steel.
  - 4. Cast iron, galvanized body.
  - 5. Manufacturer and Product: STRUCT-FAST; Gratefast, or Approved Equal.

- C. Partially Removable Anchor:
  - 1. Bolt: Threaded stud, Type 316 stainless steel.
    - a. Manufacturer: Nelson Stud Welding Co. or Approved Equal.
  - 2. Hat Bracket: Type 304 stainless steel.
    - a. Manufacturer: STRUCT-FAST or Approved Equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that opening sizes and dimensional tolerances are acceptable.

### **3.02 INSTALLATION**

- A. Fieldwork shall not be permitted on galvanized items.
- B. Perform no drilling of bolts or enlargement of holes to correct misalignment.
- C. Protect encased or embedded dissimilar metals (both dissimilar metals shall be encased or embedded) from galvanic corrosion by means of pressure tapes, coatings, or isolators.
- D. Electrolytic Protection:
  - 1. Aluminum in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, protect surfaces as specified in Section 09900.
  - 2. Allow paint to dry before installation of the material.
- E. Place metalwork to be embedded in concrete accurately and hold in correct position while the concrete is placed or, if specified, form recesses or blockouts in the concrete after it has attained its design strength and grout the metalwork in place as specified in Section 03600.
- F. Thoroughly clean the surfaces of metalwork in contact with or embedded in concrete. If accepted, recesses may be neatly cored in the concrete.
- G. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur under designed traffic loading.
- H. Install plumb or level as applicable.
- I. Install welded frames with anchors to straight plane without offsets.
- J. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.
- K. Use stainless steel anchors and accessories with aluminum gratings.
- L. Completed installation shall be rigid and neat in appearance.
- M. Commercially Manufactured Products:
  - 1. Install in accordance with manufacturer's recommendations.
  - 2. Secure grating to support members with fasteners.
  - 3. Welding is not permitted.
  - 4. Fasteners: Field locate and install.
  - 5. Permit each grating section or plank style grating assembly to be easily removed and replaced.

- N. Grating, Floor and Cover Plates:
  - 1. Field measured for proper cutouts and proper sizes.
  - 2. Field welding of aluminum grating and cover plates, if required, shall be in accordance with Structures of Aluminum Alloys 6061-T6 and 6063-T6, Section K, Fabrication published by ASCE.
  - 3. Accurately position prior to placing concrete, such that all grating and cover plates are flush with floor surfaces.
  - 4. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.
- O. Safety Stair Treads:
  - 1. Install on concrete stairs as indicated in the Drawings.
  - 2. Secure treads to concrete with suitable anchors at 15 inches on centers and not more than 4 inches from the ends.
  - 3. Provide rubber tape, 1/8-inch thick, at both ends and cut to fit shape of tread prior to concrete placement.

### **3.03 CLEANING**

- A. After installation, clean and touch up damaged surfaces of shop-primed metals with the same material used for the shop coat.

### **3.04 GALVANIZING REPAIR**

- A. Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired as follows:
  - 1. Solvent clean the damaged area per SSPC SP-1.
  - 2. Hand clean per SSPC SP-2 or power tool clean per SSPC SP-3 the damaged areas, removing all loose and cracked coating. Surface preparation shall extend into the undamaged galvanized coating.
  - 3. Repair with organic zinc-rich paint in accordance with the manufacturer's instructions.
  - 4. Acceptable manufacturer:
    - a. ZRC Galviline.
    - b. Approved Equal.

**END OF SECTION**

## DIVISION 06

### WOOD AND PLASTICS

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## SECTION 06101

### ROUGH CARPENTRY

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies rough carpentry, consisting of wood framework using lumber and plywood, and rough hardware to join the members and anchor framework to other construction.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail:

<u>Reference</u>	<u>Title</u>
ASTM A153	Standard Specification for Zinc Coating(Hot Dip) on Iron and Steel Hardware
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod, 60,000 PSI Tensile Strength
FEDSPEC FF-N-105A	Federal Specification-Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FEDSPEC TT-W-5711	Federal Specification- Wood Preservation: Treating Practice

- B. Perform the work in accordance with the following agencies:
1. Lumber Grading Agency: West Coast Lumber Inspection Bureau.
  2. Plywood Grading Agency: Certified by the Engineered Wood Association.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. A detailed list of materials and type of fasteners proposed for use.

#### PART 2 PRODUCTS

##### 2.01 LUMBER MATERIALS

- A. Unless specified otherwise, Grades and species shall be:
1. Douglas Fir: Graded in compliance with one of the following:
    - a. West Coast Lumber Inspection Bureau - Standard Grading and Dressing Rules No. 16 for Douglas Fir, West Coast Hemlock, Sitka Spruce, Western Red Cedar.
    - b. Western Wood Products Association - Grading Rules.
  2. Western Larch - Western Hemlock: May be used in lieu of Douglas fir if of equal or better stress grade and quality than the grades of Douglas fir specified and if graded in compliance with either of the grading rules specified.
- B. Seasoning:
1. Before surfacing, air or kiln dry to a moisture content not to exceed 19 percent.
  2. Before incorporation into the work, allow to attain a state of equilibrium with the local atmosphere.
  3. Air season not less than 30 days before covering with finish materials.

4. If specifications for pressure treating state the maximum percentages of moisture content at the time of treatment, comply with those requirements.

## 2.02 PLYWOOD

- A. Comply with U.S. Department of Commerce Product Standard PS 1-74. Grade and grade-mark by the Engineered Wood Association.
- B. Use the galvanized variety of bolts, nuts, and washers, in compliance with ASTM A153, in locations subject to moisture, outside, in portions of the structure that are not completely enclosed, or as indicated elsewhere.
- C. Where ply wood is indicated as an interior wall finish, provide CDX grade panels painted as specified in Section 09900 and as indicated in the Drawings.

## 2.03 ACCESSORIES

- A. Fasteners: Galvanized steel for exterior, high humidity, and treated wood locations.
- B. Bolts:
  1. Grade A, with square or hexagonal heads, comply with ASTM A307.
  2. Sizes and spacing shall be as indicated in the Drawings.
  3. Fit heads and nuts bearing on wood with washers.
- C. Nails:
  1. Sizes and types of nails shall be as indicated, specified, or required for the purpose.
  2. Comply with FEDSPEC FF-N-105A.
  3. Unless otherwise indicated, use galvanized nails.
- D. Special Purpose Nails:
  1. Acceptable Manufacturer:
    - a. Independent Nail Corporation, Bridgewater Mass.
    - b. Philstone Nail Corp., Needham Heights, Mass.
    - c. Approved Equal.
  2. Types:
    - a. "Screw Tite" common spiral thread nails.
    - b. "Tite" hardened steel, knurled masonry nails (0.148-inch to 0.177-inch diameter).
    - c. "Heavy Duty" masonry nails (0.250-inch diameter).
    - d. Concrete stub nails (0.148-inch diameter).
  3. Requirements for galvanizing or other types of noncorrosive coating shall be as specified above.

## 2.04 WOOD TREATMENT

- A. Pressure treatment: Comply with FEDSPEC TT-W-5711.
- B. Lumber in contact with concrete or masonry shall be untreated western red cedar or pressure treated Douglas fir, larch or hemlock.
- C. Acceptable treatments:

Applicable FEDSPEC		
Preservative	Final retention formula	lb/cu ft
Chromated zinc chloride	TT-W-551	0.75
Wolman salts	TT-W-573	0.35
Acid cupric chromate	TT-W-546	0.50
Chemonite	TT-W-571c	0.30



## **PART 3 EXECUTION**

### **3.01 FRAMING**

- A. Grounds and nailers:
  - 1. Accurately cut members to required sizes and securely fasten to the structure.
  - 2. Place horizontal members crown side up.
  - 3. Fasten wood nailers on steel frames with recessed bolt heads and install with washers.
- B. Plywood:
  - 1. Perform nailing as indicated in the Drawings.
  - 2. Cover all plywood nailing only after it has been inspected.
- C. Furring and stripping: Provide and shim where indicated or where necessary to align faces of finish materials in a single plane.

### **3.02 FASTENERS**

- A. Bolts: Holes for bolts in steel plates and angles shall be drilled 1/16-inch greater than bolt diameter.
- B. Powder-actuated fasteners:
  - 1. Use powder-actuated fasteners only where specifically permitted hereinafter, or when subsequently approved, provided all available safety features and guards are used.
  - 2. If adequate, use low velocity equipment.
  - 3. Submit a detailed list of equipment and type of fasteners for the Project Representative's approval prior to use.

### **3.03 CONNECTIONS**

- A. Accurately saw-cut and fit lumber into the respective locations, true to line, grade and level, as indicated or required. Permanently secure in proper position with spikes, nails, lag screws, bolts, hangers, or other fastenings, to make the work substantial and rigid in all parts and connections.
- B. Make connections between members tight, accurate, and secure.
- C. Place fastenings without splitting wood, using pre-drilling when required.
- D. Drill bolt holes to the same size as bolt diameters.
- E. Drill holes for lag screws to the same size as thread root diameters and counter-bore to the same depth and diameter as the shank.
- F. Turn lag screws in place, do not drive.
- G. Provide bolts and lag screws with washers under every head and nut that bear on the wood.
- H. Tighten bolts and lag screws at installation and carefully retighten just prior to closing in or at completion of the Project.
- I. When treated members are cut to shape or size, perform such cutting or shaping before treatment.
- J. Where members are cut after treatment or countersunk for flush installation of bolt heads, paint the cut surfaces with two saturating coats of treating liquid before installation.

**END OF SECTION**

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## SECTION 06220

### FINISH CARPENTRY AND MILLWORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Reclaimed Wood standing and running trim.
  - 2. Reclaimed Wood slat wall.
  - 3. Casework.
  - 4. Paper fiber composite countertops.
  - 5. Stainless steel countertops.
  - 6. Shop finishing.
  - 7. Fiberboard components.
  - 8. ENVISION documentation.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI A208.1	Standard for Particleboard
ANSI A208.2	Standard for Medium Density Fiberboard (MDF)
ASTM C1036	Standard Specification for Flat Glass
ASTM E84	Test Method for Surface Burning Characteristics of Building Materials
APA	American Plywood Association
AWS	Architectural Woodwork Standards, Edition. Published jointly by Architectural Woodwork Institute, Architectural Woodwork Manufacturers of Canada, and the Woodwork Institute.
BIFMA	Business Institutional Furniture Manufacturer's
U.S. Product Standard (PS) PS 1	Product Standard for Construction and Industrial Plywood.

- B. Fabricator: A minimum of 5 years experience in the fabrication of custom architectural woodwork of the type specified.
- C. Architectural Woodwork shall be under the responsibility of a single fabricator.
- D. Qualifications of Installers: Use only journeyman finish carpenters who are thoroughly trained and skilled in the work, and who are completely familiar with the materials and quality standards specified. No allowance will be made for lack of skill on the part of workmen.
- E. Conform to AWS Custom grade standards unless specified or indicated otherwise.
- F. Paper Fiber Composite Fabricator Qualifications: Certified by the paper fiber composite materials manufacturer.

- G. Mock-Ups:
  - 1. Provide mock-up in accordance with this Section.
  - 2. Fabricate one lower casework unit complete with countertop, hardware and electrical and mechanical components; and finished as specified. Select unit as directed by the Project Representative.
  - 3. Components accepted by Project Representative may be incorporated into the Work.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300 and Section 01350.
- B. Product Data:
  - 1. Submit product literature or sample of each hardware component proposed.
  - 2. Particleboard and MDF Materials: Literature verifying materials have no added urea formaldehyde.
  - 3. Paint and Adhesive Systems: Submit product literature and Material Safety Data sheets stating VOC limits and chemical component limits for each product.
- C. Shop drawings.
  - 1. Indicate materials, components, profiles and configurations, dimensions, fastening methods, jointing details, colors and finishes, and accessories.
    - a. Details shall be at a minimum scale of 1-1/2 inch per foot.
    - b. Reclaimed wood slat wall shop drawing to demonstrate spacing and layouts to meet required work points indicated in the Drawings.
- D. Samples:
  - 1. Casework Hardware: Submit sample or product literature for each type.
  - 2. Plastic Laminate Panel: Submit a minimum 8 x 11 sample of each color and pattern specified with proposed edging.
  - 3. Fiberboard Component: Submit 6 inch corner of a fiberboard cube; show jointing and finishing techniques; include transparent finish.
  - 4. Reclaimed wood slats and running trim: Submit three finished 12 inch samples of each profile indicated, demonstrating range of material color, and grain.
  - 5. Reclaimed wood slat wall corner sample measuring 12 inches in each leg direction by 24 inches tall demonstrating craftsmanship and joinery.
- E. ENVISION Submittals:
  - 1. Make ENVISION submittals in accordance with Section 01350.
  - 2. Provide required documentation for each relevant credit as required by the ENVISION Guidance Manual and the CSI Division Matrix Exhibit.

### **1.04 DEFINITIONS**

- A. Exposed Portions of Casework: Those surfaces visible when doors and drawers are closed, including edges of doors and drawers, edges of cabinet boxes visible between doors and drawers, backs of hinged doors, interiors behind glass doors, and interiors in open cabinets.
- B. Semi-Exposed Portions of Casework: Those areas not defined as exposed, but visible when solid (not glazed) doors and drawers are opened.
- C. Concealed Portions of Casework: Remaining areas not defined as exposed or semi-exposed.

## 1.05 DELIVERY, STORAGE AND HANDLING

### A. General:

1. Do not deliver wood materials to the building until "wet" work such as gypsum wallboard work has been completed.
2. Store materials indoors in ventilated area with a minimum temperature of 60 degrees F., and a maximum humidity of 55%.
3. Owner's Reclaimed Wood (WD-52) will be collected from the storage location Brightwater Operations Center at 22505 State Route 9 S.E., Woodinville, WA 98072-6010.
  - a. The Contractor must notify Project Representative 14 days prior to pickup from the Brightwater Operations Center. Project Representative will provide point of contact for drop off. Material pickup shall be between the hours of 8:00 AM and 2:00 PM. Monday through Friday, except for County holidays.
  - b. Contractor is responsible for storage of the reclaimed wood on the project site prior to installation.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Lumber:

1. Opaque Finish Lumber: AWS Grade II Poplar.
2. Concealed Framing Lumber: AWS Grade II pine, fir, hemlock, or other species as approved.
3. Moisture Content: Optimum moisture content per AWS recommendations.

#### B. Plywood:

1. Hardwood Veneer Plywood (WD-51):
  - a. Manufacturers:
    - 1) "ApplePly" by States Industries (Grade A).
    - 2) EuroPly Plus by Columbia Forest Products.
    - 3) Approved Equal.
  - b. Thickness: 3/4 inch.
  - c. Veneer: Plane sawn Maple.

#### C. Plastic Laminate:

1. PL-51: Formica 914-58 "Marine Blue".
2. PL-52: Formica 2770-58 "Sarum Gray".
3. Exposed: NEMA LD-3; general and vertical grade.
4. Backing Sheets: NEMA LD-3; backing grade; undecorated.

#### D. Paper Fiber Composite Countertops (PCCC-51):

1. Acceptable Products:
  - a. Richlite.
  - b. PaperStone.
  - c. Approved Equal.
2. Colors: To match Richlite "Slate".
3. Thickness: 3/4 inch.
4. Fabricate paper fiber composite elements to the configurations indicated in accordance with the manufacturer's recommendations.

#### E. Stainless Steel Countertops:

1. ASTM A840; Type 304 or 316 stainless sheet; minimum 16 gage.

- F. Reclaimed Wood (WD-52): Owner's own reclaimed material.
  - 1. AWS "premium" grade; random widths, surfaced on four sides in pattern and profiles indicated in the Drawings.
    - a. Do not fill nail holes.

## 2.02 ACCESSORY MATERIALS

- A. Cabinet Hardware:
  - 1. Drawer Slides: Full extension ball bearing; clear zinc finish; rail mount; Accuride, or Approved Equal; load rating as required for the application.
    - a. Light Duty Rating (drawers 12 inches wide or less): Accuride 2632, or Approved Equal; 65 lb BIFMA load rating.
    - b. Medium Duty Rating (drawers 32 inches wide or less): Accuride 7432, or Approved Equal; 100 lb BIFMA load rating.
    - c. Heavy Duty Rating (drawers 42 inches wide or less): Accuride 3640, or Approved Equal; 200 lb BIFMA load rating.
  - 2. Cabinet Locks: Olympus Lock, or Approved Equal; 5 pin tumbler cylinder locks; ANSI Grade 1; configuration to suit condition; keyed alike as directed, and masterkeyed. Furnish two keys for keyed alike group, and four masterkeys; finish to match pulls.
  - 3. Concealed Hinges: European style; concealed; 120 degree of opening, Blum, Salice, Hafele, or Approved Equal; self-closing, except at touch latches.
  - 4. Cabinet Shelf Brackets: Metal pin style support; chrome finish.
  - 5. Wiring Grommets: "TG Series" by Doug Mockett and Company, Inc., or Approved Equal; size to match application; color as selected by Project Representative from manufacturer's standard colors.
- B. Closet Hardware:
  - 1. Closet Rod: Knap & Vogt # 770 5, or Approved Equal; 1-5/16 inch diameter; chrome finish.
  - 2. End Flanges: Knap & Vogt # 764/766, or Approved Equal; chrome finish.
- C. Wall Shelf Hardware:
  - 1. Brackets: Knap & Vogt # 185 Anochrome finish or Approved Equal; length as appropriate for shelving indicated.
  - 2. Standards: Knap & Vogt # 85 Anochrome finish or Approved Equal.
- D. Counter Support Brackets:
  - 1. All brackets to be concealed unless otherwise noted. If not concealed, use one the following:
    - a. Federal Brace.
    - b. Oodles of Parts Plus.
    - c. A&M Hardware Inc.
    - d. Steelcase.
    - e. Herman Miller.
    - f. Approved Equal.
  - 2. Bracket: "Work Station Bracket"; 1/8" steel; sized and spaced according to the proposed counter load and use, unless otherwise indicated; stainless steel finish.
- E. Contact Bond Adhesive: Waterborne type; limit VOC content to 250 g/L or less.
- F. Low VOC Polyurethane: Polyureseal BP by American Formulating and Manufacturing, or Approved Equal; maximum 350 g/L VOC.
- G. Binding Screws:
  - 1. Wide flange head binding wood or machine screws; 17mm wide flat flange head with 1.5mm beveled edge; 2 mm head height; 4mm hex drive; bronze plated steel.
  - 2. Acceptable Manufacturers:
    - a. McMaster Carr, "Binding Screw"; [www.mcmaster.com](http://www.mcmaster.com). Products as listed below:

- 1) Wood Binding Screws: #90835A400, 90835A410, or 90835A420.
- 2) Machine Binding Screws: #90835A108 or 90835A110; ¼" -20; provide matching nuts and washers.
- b. Approved Equal.
3. Lengths as required to fit the conditions indicated.

## **2.03 STANDING AND RUNNING TRIM FABRICATION**

- A. Shop fabricate trim to the shapes indicated.
- B. Assemble built-up sections. Glue lines shall be free of squeeze-out where transparent finishes are to be applied.
- C. Tolerances for overall assembly dimensions shall be within 1/32 of an inch.
- D. Shop fit and assemble to the greatest extent possible.
- E. Back or kerf cut trim greater than 2 inch in width, except terminate before exposed ends.
- F. Fabricate trim from solid lumber or wood veneer over particleboard or MDF core.
- G. Veneer Clad Trim:
  1. Provide minimum 1/4 inch thick solid wood edging at veneer clad trim. Veneer shall lap over the solid wood edging.
  2. Veneer shall be placed without joints at each continuous surface.
  3. Veneer clad trim shall match solid lumber trim in appearance.

## **2.04 CASEWORK FABRICATION**

- A. General Fabrication Requirements:
  1. Fabricate to the configurations indicated, unless reviewed otherwise on the shop drawings.
  2. Conceal all fasteners.
  3. Provide openings in casework for the incorporation of electrical and mechanical components. Openings for all plumbing equipment shall be cut from templates obtained from the plumbing equipment installer.
  4. Provide concealed access to casework electrical fixtures and wiring.
  5. Unless indicated or approved otherwise, provide adjustable base to provide level installation which accommodates variations in floor levelness.
  6. Shop assemble casework to the greatest practical extent.
  7. Adjustable Shelves: Casework shelves shall be adjustable, unless otherwise noted. Provisions for shelf adjustment shall be by drillings at 2 inches on center in the cabinet body for the placement of shelf support brackets. Provide 4 supports for each shelf. Drillings shall be in straight even lines.
  8. Provide hardware, fasteners, and exposed trim.
  9. Provide openings with wiring grommets at locations indicated. When not indicated, provide openings with wiring grommets along countertops with knee spaces underneath. Space at 36 inches maximum, with a minimum of one opening per knee space.
- B. Casework Construction:
  1. Fabricate casework in accordance with AWS standard Section 10; "Custom" grade.
  2. Design: AWS Flush Inset design, unless indicated otherwise. Joint between exposed doors, drawer faces, and countertop edges shall be 1/8 inch plus or minus 1/16.
  3. Exposed Surfaces: Plastic laminate clad or transparent finished hardwood plywood with exposed edges as indicated in the Drawings; provide hardwood trim at locations indicated.
  4. "Inside" Exposed Surfaces of Shelving Units and Cabinets without Doors: Plastic laminate finished board, with exposed edges.

5. Provide vertical grade plastic laminate.
  6. Backs of Doors and Drawers: wood veneer. Shelves shall be 1 inch thick, minimum.
  7. Veneers shall be as follows:
    - a. Fabricate each panel from sequential flitches.
    - b. Book match veneers.
    - c. Provide no veneer end joints within each panel.
    - d. Provide grain direction as indicated.
- C. Paper Composite Countertops:
1. Fabricate paper fiber composite elements to the configurations indicated in accordance with the manufacturer's recommendations.
- D. Stainless Steel Countertops and Backsplashes:
1. Fabricate from stainless steel sheet to the configurations indicated.
  2. Fabricate each countertop in one piece to the greatest extent possible.
  3. Provide welded seamless corners and joints; grind all welds smooth to match adjacent surfaces.
  4. Provide turned down fronts and exposed sides; integral back splashes with 3/8 inch radius.
  5. Fabricate countertops with three formed stainless steel channels welded underneath for support.
  6. Spray on sound deadening to the underside of the countertops.
  7. Finish: #4 finish.
- E. Wall and Closet Shelf Fabrication:
1. Fabricate from plastic laminate finished particleboard; edge banded with matching plastic laminate edging unless indicated otherwise.
  2. Provide minimum 3/4 inch thick shelves, except provide thicker shelves as required to support the loads and spans indicated without significant deflection.
- F. Hardware:
1. Unless otherwise indicated or specified, drawers shall be equipped with standard full extension slides.
  2. Install hardware straight and true and in perfect alignment horizontally and vertically with adjacent casework and hardware.
  3. Carefully fit and securely attach cabinet hardware in accordance with manufacturers' printed instructions, and exercise caution not to mar or injure finish surfaces.

## **2.05 SHOP FINISHING**

- A. Shop finish architectural woodwork wood surfaces.
- B. Sand exposed and semi-exposed wood surfaces smooth, always sanding in the direction of the wood grain.
- C. Sand exposed transparent finish wood surfaces to AWS "Premium" grade standards. Sand semi-exposed transparent or opaque finish wood surfaces to AWS "Custom" grade standards.
- D. Fill depressions and imperfections with color matched putty, except imperfections shall not exceed AWS Premium grade standards.
- E. Transparent Finish Coating: Spray apply in accordance with AWS finishing system, Premium Grade Waterborne Conversion Varnish; satin sheen.

## **2.06 FIBERBOARD COMPONENT FABRICATION**

- A. Fabricate fiberboard components to the shapes indicated.



- B. Adhesively bond joints. Mechanically secure with set finishing nails or counter sunk screws.
- C. Fill depressions with sandable non-shrink putty, and sand smooth with adjacent surfaces. Sand joints smooth to create a monolithic appearance for each element.
- D. Sand exposed painted surfaces to AWS "Custom" grade standards.
- E. Fabricate elements in the shop to the greatest extent possible. Fabricate to allow for field installation of the elements with concealed fastening systems.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Coordinate the installation of blocking and other supports required for the installation of architectural woodwork elements.

### **3.03 STANDING AND RUNNING TRIM INSTALLATION**

- A. Jointing: Make joints to conceal shrinkage; miter exterior corners; cope interior corners, miter or scarf end-to-end joints; install trim pieces as long as possible, jointing only where solid support is obtained. Make no joints closer than 4 feet to corners.
- B. Lengths of Material:
  - 1. Provide continuous lengths where ever possible.
  - 2. For excessively long runs, use random lengths; minimum length shall be 8 feet, except where short lengths are required by installation conditions.
- C. Fastening:
  - 1. Install items straight, true, level, plumb, and firmly anchored in place; where blocking or backing is required, coordinate as necessary with other trades to ensure placement of required backing and blocking in a timely manner.
  - 2. Fasten trim with finish nails or screws of proper dimension to hold the member firmly in place without splitting the wood.
  - 3. On exposed finish work, set nails and screws.
  - 4. Align exposed fasteners for uniform pattern; random or "shotgun" patterns will not be accepted.
- D. Select and arrange standing and running trim so that abutting members have a similar grain and color match to the greatest extent possible.

### **3.04 CASEWORK INSTALLATION**

- A. Coordinate casework installation with work of other trades for final electrical and mechanical connections.

- B. Install casework accurately, plumb, square, and level, and permanently secured in precise position as indicated in the Drawings. Casework shall be scribed to adjacent surfaces as follows:
  - 1. Countertops and splashes to wall surfaces.
  - 2. Cabinet endwalls and other exposed surfaces to walls.
- C. The casework installation shall be made complete with required fastenings, clip angles, braces, anchors, adjustable levelers, and other fittings as required to render the work rigid and secure.
- D. Fasteners securing casework shall be in concealed or semi-concealed locations, unless approved otherwise.
- E. Avoid damaging finished surfaces. Repair or replace damaged materials and surfaces in a manner approved by the Project Representative.
- F. Upon completion of work, and in the Project Representative's presence, demonstrate hardware to work freely as intended.

### **3.05 RECLAIMED WOOD SLAT WALL**

- A. Install in the locations and coursings indicated in the Drawings.
- B. Fasten with concealed fasteners at minimum 8 inches on center. Coordinate installation of blocking as specified in this Section .
- C. Allow space for expansion and contraction.
- D. Reclaimed wood slats shall use random width boards between 1x2, 1x4, 1x6, and 1x8. No two sizes shall be adjacent, and at least one of each width board shall be used within any 3 foot length.

### **3.06 FIBERBOARD COMPONENT INSTALLATION**

- A. Unless indicated otherwise, install items straight, true, level, plumb; firmly anchor in position.
- B. Install with concealed fasteners. Set exposed fasteners, fill with sandable non-shrink filler, and sand smooth.

### **3.07 SITE FINISHING FOR SHOP FINISHED ELEMENTS**

- A. Apply wood filler to exposed fastener indentations and other minor imperfections.
- B. Use matching wood filler at surfaces with shop applied transparent finishes.
- C. Items which have been shop finished shall be retouched as necessary to conceal damage and blemishes. Items which cannot be successfully repaired shall be replaced with new complying items.

### **3.08 CLEANING UP**

- A. Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends, and debris.
- B. At the end of each working day, or more often if necessary, thoroughly sweep and/or vacuum surfaces. Remove the refuse to the area of the job site set aside for its storage.

### **END OF SECTION**

## SECTION 06510

### FIBERGLASS REINFORCED PLASTIC (FRP)

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies general requirements for fiberglass reinforced plastic (FRP) including items fabricated with both polyester and epoxy resins.
- B. Equipment-specific requirements are detailed in other Sections of the Contract Documents pertaining to specific equipment. This Section is to be used in conjunction with the other related equipment Sections and as indicated in the Drawings. If conflict, the specific equipment Specification shall govern.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASME Boiler and Pressure Vessel Code ASTM C581	Section X, Fiberglass-Reinforced Plastic Pressure Vessels Pressure Vessel Code Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D883	Standard Terminology Relating to Plastics
ASTM D2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D3299	Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
National Bureau of Voluntary Stds PS 15-6	Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment
ASTM D4097	Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
(NBS PSI5-69 replacement)	Thermoset Resin Chemical-Resistant Tanks The Society of the Recommended Practice for Shipping and Installation of Plastics Industry, Inc. Reinforced Plastic Pipe, Duct, and Tanks
NFPA No. 30	Flammable and Combustible Liquids Code

B. Allowable Tolerances:

1. Test Tolerances:

- a. The average value of each of the tests performed on sample specimens for each individual FRP item shall satisfy the requirements set forth in:
  - 1) Table A, Hardness Requirements for Resins.
  - 2) Table B, Minimum Requirements for Laminate Fabrication, ASTM D3299 and PS 15-69.
- b. Should an individual FRP item be found deficient in any of the tests, the testing laboratory shall select a second series of sample specimens as specified in Section 06510 and shall perform all tests on these specimen coupons. Failure of the second series of coupons to satisfy the physical requirements shall constitute cause for rejection of that individual FRP item.

**TABLE A - HARDNESS REQUIREMENTS FOR RESINS**

Resins b	Barcol hardness, c minimum average
<b>Type A (non-fire resistant)</b>	
Atlac 382	30
Atlac 382 (4010A) d	35
Atlac 580	30
Derakane 411-45d	30
Derakane 470-36	40
Dion Cor-Res 6694	30
Dion Cor-Res 7000d	30
Hetron 197	40
<b>Type A (fire-resistant)</b>	
Atlac 711-05A plus 3% antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	30
Atlac 797AT plus 3% antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	40
Derakane 510N	30
Derakane 510A-40 plus 5% antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	30
Dion Cor-Res 6695 plus 3% antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	30
Hetron 92 FR	40
Hetron 197 plus 5% antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	40
Hetron 800 FR	40
<b>Type B (non-fire-resistant)</b>	
Aropol 7240	40
Atlac 400	35
Dion/SO 6631	40
<b>Type B (fire-resistant)</b>	
Atlac 793 plus 5 percent antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	30
Dion Cor-Res 6693 plus 5 percent antimony trioxide (Sb <sub>2</sub> O <sub>3</sub> )	30

Notes:

- 1) For resins not listed, Barcol hardness shall be at least 90 percent of the resin manufacturer's minimum specified hardness for the cured resin.
- 2) For description of Types A and B resins, refer to Paragraph 06510-2.01A.
- 3) Determined with Barcol impressor, Model GYZJ 934-1 calibrated at 2 points in accordance with ASTM D2583.
- 4) Resins that shall be used for filament-winding construction.

**TABLE B - MINIMUM REQUIREMENTS FOR LAMINATE FABRICATION BY CONTACT MOLDING, MATCHED DIE MOLDING, AND FILAMENT WINDING**

Method of Laminate Fabrication	Property	Laminate Thickness, inches			
		3/16 & less	1/4	5/16	3/8 & up
Contact molded, and matched die molded	Glass content percent	25-30	30-34	34-38	38-42
Filament wound process	Glass content percent	25-30	30-34	34-38	38-42
	Ultimate tensile strength, psi	40,000	40,000	40,000	40,000
	Modulus of elasticity (tangent), psi	$3 \times 10^6$	$3 \times 10^6$	$3 \times 10^6$	$32 \times 10^6$

NOTES:

- 1) Minimum hoop tensile strength.
- 2) Minimum hoop tensile modulus of elasticity.

C. Product Tolerances:

1. General: Reject any FRP specialty item that does not satisfy the tolerances specified in this Section.
2. Section Uniformity: Wall, flange and edge thickness shall be uniform to within  $+1/32$  of an inch in 12 inches.
3. Color: Items of a similar nature or subassemblies of a single unit shall be similar in color.
4. Out-of-Round and Parallel:
  - a. Unless otherwise indicated, the out-of-round tolerance for cylindrical sections 12 inches in diameter and greater shall be  $1/2$  that listed in NBS PS-15 for ductwork. The out-of-round tolerance for cylindrical sections smaller than 12 inches in diameter shall be as listed in NBS PS-15.
  - b. Out-of-parallel tolerance for rectangular and square sections shall be as specified for out-of-round.
5. Flanges:
  - a. Flange faces shall be flat and true to a tolerance of  $+1/32$ -inch for tanks, and 1 percent of the nominal diameter or  $1/8$ -inch for ducts, whichever is less.
  - b. Variation in manhole flange thickness shall be within  $+1/16$ -inch. Variations in all other flanges shall be within  $+1/32$ -inch. Tolerance in bolt hole locations and in bolt circle diameter shall be within  $+1/16$ -inch.
6. Surfaces: Tolerances for defects on the surface of FRP items are specified in Table C of this Section.

**TABLE C - ALLOWABLE PRODUCT SURFACE TOLERANCES**

Defect Cracks	Surface Inspected	
	Process Side	Non-process Side
Crazing (fine surface cracks)	None	Max. length: $1/2$ -inch
		Max. density: 5 per sq. ft.
		Min. separation: 2-inch
Blisters (rounded elevations of the laminate surface over bubbles)	None	Max. dimension: $1/4$ -inch dia x $1/8$ -inch high
		Max. density: 1 per sq ft.
		Min. separation: 2-inch apart
Wrinkles and solid blisters	Max. deviation: 10% of wall thickness, but not exceeding $1/8$ -inch	Max. deviation: 10% of wall thickness, but not exceeding $1/8$ -inch

Defect Cracks	Surface Inspected	
	Process Side	Non-process Side
Pits (craters in the laminate surface)	Max. dimension: 1/8-inch dia. x 1/32-inch deep	Max. dimension: 1/8-inch dia. x 1/16-inch deep
	Max. number: 10 per sq. ft.	Max. density: 10 per sq.ft.
Surface porosity (pin holes or pores in the laminate surface)	None	None
Chips	None	Max. Dimension of break: 1/4 inch and thickness no greater than 10% of wall thickness
		Max. density: 1 per sq ft
Dry spot (nonwetted reinforcing)	None	Max. dimension: 2 sq inch per sq ft
		Max. dimension of break: 1/4-inch and thickness no greater than 10% of wall thickness
Entrapped air (bubbles or voids in the laminate)	Max. dia.: 1/16-inch	Max. dia. and density: /8-inch and 4 sq inch or 1/16-inch and 10 per sq inch
	Max. density: 10 per sq. inch but none to a depth of 1/32 -inch	
Exposed glass	None	None
Burned areas	None	None
Exposure of cut edges	None	None
Scratches	None	Max. length: 1 inch
		Max. depth: 0.010-inch
Foreign matter	None	None

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Manufacturer and method of fabrication.
- C. Materials selected for laminates to be furnished for project.
- D. Manufacturer's shop drawings:
  - 1. Grating: Show dimensions, weight, size, and location of connections to adjacent grating, supports, and other Work.
  - 2. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
- E. Installation procedures, including field-jointing techniques.
- F. Cuttings required for nozzles and openings, for sample specimens to be tested.

### 1.04 PRODUCT SHIPPING, STORAGE AND HANDLING

- A. Be responsible for proper packaging and protection of all materials to prevent damage during shipping, handling and storage.
- B. As material arrives on site, it will be inspected for compliance with "Recommended Practices for Shipping and Installation of Reinforced Plastic Pipe, Duct and Tanks". The Society of the Plastics Industry, Inc.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Resins:
  - 1. General:
    - a. Resins used for FRP specialties exposed to view shall contain antimony compounds or other fire retardant agents and shall have a flame spread rating of 25 or less based on ASTM E84.
    - b. No thixotropic agent shall be added to resins used for a corrosion barrier.
      - 1) Up to 2 percent by weight of thixotropic agent may be added for viscosity control of resins not used for a corrosion barrier. The quantity of thixotropic agent added, however, shall not interfere with visual inspection of the laminate.
      - 2) No other fillers to the resin, including pigments, dyes and colorants, shall be permitted.
  - 2. Type A Resin:
    - a. Shall provide sufficient chemical resistance under the corrosive environments listed in the detailed Specifications for FRP structures and equipment.
    - b. Where specified, shall also meet flame spread requirements as given in this Section.
    - c. Shall be selected from the resins listed in Table A of this Section.
  - 3. Type B Resin:
    - a. Shall be suitable for weather-resistant, non-corrosive chemical service and, where specified, shall meet flame spread requirements as given in this Section.
    - b. Shall be selected from the resins listed in Table A of this Section.
    - c. Type A resins may be substituted for Type B resins.
- B. Reinforcement:
  - 1. General: Glass reinforcement shall be Type C, chemical glass, or Type E, electrical glass, as specified.
  - 2. Surfacing Veil:
    - a. Type C glass surfacing mat with silane finish and styrene-soluble barrier.
    - b. Thickness: 10 to 20 mils for all applications, except those involving exposure to chlorine or hypochlorite solutions, where a minimum 20-mils thickness shall be employed.
    - c. Surfacing veils for applications where the glass may be attacked by compounds in the process shall be a suitable spun-laced synthetic organic entangled fiber fabric, such as Nexus, not less than 20 mils in thickness, backed by chopped strand in a Type A resin.
  - 3. Chopped Strand Mat: Type E glass, 1-1/2 oz/sq ft with silane finish and a styrene-soluble binder.
  - 4. Continuous Roving:
    - a. That used in chopper guns for spray-up shall be Type E glass with chrome finish or silane coupling agent.
    - b. Continuous roving used for filament winding shall be Type E glass with silane-type finish.
  - 5. Woven Roving: Type E glass, 24 oz/sq yd, 4 by 5 weave, with silane-type finish.
  - 6. Woven Cloth: Type E glass with silane-type finish.
- C. Miscellaneous:
  - 1. Stainless Steel: Unless otherwise indicated, stainless steel nuts, bolts, washers, hangers and miscellaneous fabricated parts shall be ANSI Type 316.
  - 2. Gaskets: Unless otherwise indicated, gaskets shall be neoprene.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Ship, install, join and erect FRP specialties under the direction of factory-trained specialists.
- B. Where jointing is required, employ workers who have been trained in proper jointing techniques by the FRP manufacturer's representative.

- C. Affix to fabricated equipment a warning reading "Plastic Equipment Handle with Care", stenciled on two sides in letters a minimum of 2 inches high.

### 3.02 FABRICATION

- A. Fabricate FRP items by the contact molding, filament winding, or pultrusion method.
  - 1. Contact Molding: Unless otherwise indicated, contact-molding fabrication shall be in conformance with NBS PS-15. Perform lay-up in the following sequence:
    - a. Provide an interior surface corrosion barrier consisting of the laminate specified in Paragraphs 2 and 3. Laminate thickness shall be 100-mils minimum. Do not use a separately cured, unreinforced gel coat.
    - b. Make the interior surface resin-rich, smooth and reinforced with a 10- to 20-mil Type C glass-surfacing veil saturated with Type A resin.
    - c. Cover the interior surface layer with a minimum of 3 ounces per square foot of chopped strand mat and resin in 2 plies of 1 1/2-ounce mat saturated with Type A resin.
    - d. Allow corrosion liner laminate consisting of the layers specified in Paragraphs 2 and 3 to gel.
    - e. For laminates of 3/16-inch nominal thickness, continue mat plies or spray- as required with adequate rollout between the application of each chopped pass or mat.
    - f. For laminates of 1/4-inch nominal and thicker, apply mat (1-1/2 ounces per square foot) or spray-up and woven roving (24-1/2 ounces per square yard, 5 x 4 weave) to the total required to achieve the desired nominal thickness.
      - 1) Two adjacent plies of woven roving will not be permitted.
      - 2) Roll out each ply or pass.
      - 3) Include at least 1 ply of woven roving for reinforcement for laminates having a nominal thickness of 1/4-inch.
      - 4) If interruption of laminate buildup is required for exotherm, such interruption shall be permitted only after every third ply of woven roving has been laid.
    - g. Provide an exterior surface corrosion barrier of 100 mils minimum thickness for buried FRP storage tanks and for FRP specialties exposed to corrosive exterior environments.
      - 1) Corrosion barrier shall consist of a 2-pass chop, Type C glass veil and Type A resin as specified in Paragraphs 2 and 3.
      - 2) Exterior surfaces of FRP specialties not exposed to corrosive environments shall be Type C glass veil and Type A resin, 15 mils minimum thickness.
    - h. Make the outer surface of the fabricated product relatively smooth and such that no glass fibers are exposed.
    - i. Incorporate paraffin for full cure in the final coat of resin.
    - j. Lap all edges of reinforcement material to a minimum of 1 inch for mat and 2 inches for woven roving. Stagger lapped edges of adjacent layers.
    - k. For all cut edges on parts that will make up a secondary joint or will be incorporated into a finished product, first apply a seal with at least 2 coats of lay-up resin.
- B. Filament Winding:
  - 1. Unless otherwise indicated, filament-winding fabrication shall be in conformance with ASTM D3299. Sequence of laminate construction shall be as follows:
    - a. Provide an interior surface corrosion barrier consisting of the laminate specified in Paragraphs 2 and 3. Laminate thickness shall be 100 mils minimum. Do not use a separately cured unreinforced gel coat.
    - b. Make surfaces exposed to the fluids to be resin rich, smooth and reinforced with a 10- to 20-mil thick Type C glass veil mat saturated with Type A resin.
    - c. Follow the inner surfacing layer with a minimum of 3 ounces per square foot or more of chopped strand mat and resin in a minimum of 2 plies saturated with Type A resin. Glass content of this portion of the laminate shall be 25 to 30 percent by weight. For laminates 1/2-inch and thicker, the nominal 100-mil layer shall have a thickness of at least 90 mils after curing.
    - d. Subsequent reinforcing shall be resin-saturated, continuous roving, as may be required to satisfy all other requirements of this Section.



- e. Additional chopped roving and resin may be sprayed up between winding cycles to provide improved resistance to interlaminar shear.
- f. For underground FRP storage tanks and for FRP specialties exposed to corrosive exterior environments:
  - 1) Provide an exterior surface corrosion barrier of 100 mils minimum thickness.
  - 2) Corrosion barrier shall consist of a 2-pass chop, Type C glass veil and Type A resin as specified in Paragraphs 2 and 3.
  - 3) Exterior surfaces of FRP specialties not exposed to corrosive exterior environments shall be Type C glass veil saturated with Type A resin, 15-mils minimum thickness.
- g. Allow no glass fibers to be exposed on the outer surface.
- h. Incorporate paraffin for full cure in the final coat of resin.
- i. Provide a chemical resistant liner consisting of 2 mats and a veil for cut edges exposed to the chemical environment. Do not use cloth or woven roving for this purpose.
- j. For all cut edges on parts that will make up a secondary joint or be incorporated into a finished product, first apply a seal with at least 2 coats of lay-up resin.

### **3.03 ASSEMBLY AND ERECTION PLANS**

- A. Prior to assembly and erection of FRP towers, tanks, stacks and similar structures, provide assembly and erection plans prepared by the FRP manufacturer.
- B. The plans shall provide details on handling, field connections and final installation.

### **3.04 FIELD JOINTS**

- A. Bell and spigot or butt-strap type.
  - 1. Bell and spigot:
    - a. The provisions of this Section and the detailed Specification with respect to surface veils, laminate thickness and design shall apply to both the bell and spigot without regard to any consideration that they will ultimately be joined to each other.
    - b. Design bell and spigot to be airtight and watertight.
    - c. Upon completion of jointing, wrap bell and spigot joints with a butt-strap joint as described below.
  - 2. Butt-strap:
    - a. Thickness: Not less than 1-1/2 times the longest cross-sectional dimension of the FRP specialty.
    - b. Shall develop at least 200 percent of the strength of the parent laminate. Notwithstanding this requirement, butt-strap joints shall be comprised of at least 2 layers of surfacing veil plus sufficient reinforcing glass impregnated in the specified barrier resin.
    - c. Surface preparation, methods of curing, and ultraviolet light protection shall be as specified for the parent laminate.

### **3.05 DAMAGED OR DEFECTIVE AREAS**

- A. Repair damaged or defective areas that are otherwise acceptable.

### **3.06 TESTING**

- A. Sampling:
  - 1. Cut sample specimens at locations selected by testing laboratory personnel from items fabricated for the Project.
  - 2. Take sample specimens at a rate of 1 per 1,000 square feet of surface area, with a minimum of 5 specimens per individual item.
  - 3. An individual FRP item shall be defined as an FRP product that is unique in fabrication and dimension from all other FRP products.
  - 4. Identify sample specimens by item sampled and sampling location.

5. Save cuttings required for nozzles, openings or connections and submit as sample specimens to be used for testing.

- B. Tests: Tests to be performed on each sample specimen may consist of the following from the National Bureau of Standards Voluntary Standard PS 15:

Glass Content:	Subsection 4.3.1
Tensile Strength:	Subsection 4.3.2
Flexural Strength:	Subsection 4.3.3
Modulus of Elasticity (Tangent):	Subsection 4.3.4
Hardness:	Subsection 4.3.5

**END OF SECTION**

## SECTION 06630

### FIBERGLASS REINFORCED PLASTIC (FRP) GRATING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies fiberglass reinforced plastic (FRP) grating.
- B. Fabricate grating provided under this Section by the flooded-mold process. Grating manufactured by any other method will not be acceptable.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C581	Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D883	Standard Terminology Relating to Plastics
ASTM D2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D3299	Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
	National Bureau of Custom Contact-Molded Reinforced-Polyester Chemical-Resistant
	Standards Voluntary Process Equipment Standards PS 15-6
ASTM D4097	Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
NBS PSI5-69	Thermoset Resin Chemical-Resistant Tanks replacement
	The Society of the Recommended Practice for Shipping and Installation of Reinforced Plastics Industry, Inc. Plastic Pipe, Duct, and Tanks
NFPA No. 30	Flammable and Combustible Liquids Code

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Submittals shall be as set forth in Section 06510.

## 1.04 PERFORMANCE AND DESIGN REQUIREMENTS

### A. Design:

1. Design FRP grating in accordance with the following:
  - a. A minimum structural safety factor of 5.
  - b. Unless otherwise indicated, design loads for FRP grating shall be as follows:
    - 1) 100 psf.
    - 2) Maximum deflection shall be the quotient of the grating span divided by 180 or 1/2-inch, whichever is less.
  - c. Unless otherwise indicated, FRP grating shall have a maximum deflection of 1 percent when supported at 2-foot centers and subjected to a uniform load of 110 pounds per square foot.
  - d. Type A resin shall be used for all grating.
2. The minimum thickness of all FRP grating shall be 1 inch. Grating sheet sizes shall be compatible with the support spans indicated in the Drawings and shall require a minimum of field cutting.

### B. Corrosion Resistance: FRP grating shall be suitable for continuous service under the following conditions:

	Concentration	Maximum
Service	by weight, percent	temperature, degrees F
Chlorine gas (a)	10	100
Chlorine solution	Saturated	100
Hydrogen sulfide (a)	5	100
Hypochlorite solution	5	100
Hypochlorous acid	10	100
Potassium permanganate	10	100
Sodium hydroxide	50	100
Sulfuric acid	10	100

(a) Wet or dry.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. In accordance with Section 06510.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Provide FRP grating with hold-down attachments, end panel attachments, and appurtenances to make the work complete and operable.
- B. Adequate quantities of resin sealing kits comprised of pre-measured quantities of thixotropic resin and catalyst, mixing containers, chip brushes, and stirring sticks shall be provided by the fabricator.
- C. Installation of FRP grating shall be as recommended by the FRP grating fabricator.

### 3.02 FABRICATION

- A. Fabricate FRP grating by the flooded mold process with the reinforcing glass of the bearing bars interwoven with the reinforcing glass of the cross bars.
- B. Assembled and glued bar grating will not be acceptable.

- C. The resin shall completely wet the glass surface to prevent infiltration of corrosives into the glass reinforcement.
- D. FRP grating used as walking surfaces shall be slip resistant.
- E. All edges of FRP grating shall be banded.

**END OF SECTION**

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## **DIVISION 07**

### **THERMAL AND MOISTURE PROTECTION**

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## **SECTION 07130**

### **BELOW GRADE WATERPROOFING**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes specifications for furnishing and installing the waterproofing.
- B. The work of this Section includes the following:
  - 1. Sheet membrane waterproofing.
  - 2. Fluid applied waterproofing.
  - 3. Protection layer.
  - 4. Leveling layer.
  - 5. Separation layer.

##### **1.02 QUALITY ASSURANCE**

- A. Manufacturer: Minimum of 20 years experience in the production and sale of waterproofing systems.
- B. Installer: Manufacturer's certified installer with a minimum of 5 years experience in the type of work required of this Section.
- C. Materials: Primary products from one manufacturer.
- D. Pre-Installation Meeting: Prior to the commencement of field operations to establish procedures to be used during construction. Meeting agenda shall include discussions on:
  - 1. Waterproofing details:
    - a. Utility penetrations through waterproofing.
    - b. Waterproofing protection.
    - c. Waterproofing damage repair.
    - d. Substrate conditions.
    - e. Reinforcing steel placement.
    - f. Concrete placement.
    - g. Concrete forming system.
- E. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on site periodically during waterproofing work to review installation procedures.
- F. Single Installer: Installation of the waterproofing membrane, flashing, protection layers, separation layers, and leveling layers shall be the responsibility of the membrane applicator.

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300 and Section 01350.
- B. Product Data: Submit manufacturer's product data, installation instructions, MSDS information, use limitations, and recommendations.
- C. Samples: Submit representative samples of the following:
  - 1. Sheet membranes specified.
  - 2. Shop drawings: Details and installation procedures not covered by manufacturer's instructions and product data sheet.
  - 3. Manufacturer Certification: Certify installer as trained and acceptable to manufacturer.

4. Installer Previous Experience: List of 5 representative projects installed within the last 5 years using the specified waterproofing system. Include the owner's name and telephone number, location of project, square feet of product installed and completion date.
5. Remedial Measures: Description of proposed remedial measures to be used, if measured water infiltration rates, exceeds the allowable value.

#### **1.04 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of membrane on the job Site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect primer, mastic, and adhesive from moisture.
- D. Store protection layer material flat and off the ground. Provide cover on top and all sides.
- E. Protect flammable materials from possible sources of ignition.

#### **1.05 PROJECT CONDITIONS**

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive waterproofing.

#### **1.06 WARRANTY**

- A. Waterproofing: Provide written 5-year water-tightness warranty issued by the membrane manufacturer upon completion of the Work.

#### **1.07 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Maximum water infiltration rate of the pump station addition with completed waterproofing system shall not exceed 0.2 gallon per minute.
- B. Actual water infiltration rate shall be measured following completion and surface pavement restoration. If measured infiltration rate exceeds the maximum allowed value, provide repairs to bring the pump station into compliance with the maximum allowable value.

### **PART 2 PRODUCTS**

#### **2.01 WATERPROOFING SYSTEMS**

- A. Provide one of the following waterproofing systems, or Approved Equal:
  1. HDPE sheet membrane and fluid applied membrane system:
    - a. Manufactured by Grace Construction Products.
    - b. Preprufe 300R membrane at bottom slab.
    - c. Preprufe 160R membrane at blind-side walls cast against shoring.
    - d. Bituthene 3000 membrane at walls without shoring.
    - e. Hydroduct 220 drainage composite adjacent to waterproofing membrane at all vertical walls.

- f. Hydroduct Coil 600 drainage composite at base of Hydroduct 220.
- B. The waterproofing system shall be applied to all exterior surfaces as indicated in the Drawings and shall provide a complete, uninterrupted water barrier.

## **2.02 MATERIALS**

- A. Preprufe 300R, or Approved Equal membrane shall be a 0.046-inch nominal thickness composite sheet membrane consisting of a 0.032-inch layer of high density polyethylene film and a 0.014 inch layer of adhesive.
- B. Preprufe 160R, or Approved Equal membrane shall be a 0.032-inch nominal thickness composite sheet membrane consisting of a 0.016 inch layer of high density polyethylene film and a 0.016 inch layer of adhesive.
- C. Bituthene 3000, or Approved Equal membrane shall be a 0.060 inch nominal thickness composite sheet membrane consisting of a 0.004 inch layer of cross laminated high density polyethylene film and a 0.056 inch layer of rubberized asphalt adhesive.
- D. Hydroduct 220, or Approved Equal shall be a 0.44 inch nominal thickness geocomposite drainage sheet consisting of a geotextile filter fabric bonded to a HIP polymer core with a minimum flow rate of 17 gal/min/ft.
- E. Hydroduct Coil 600, or Approved Equal shall be a 1 inch nominal thickness geocomposite drainage sheet consisting of a geotextile filter fabric bonded to a HIP polymer core with a minimum flo gradient of 17-80 gal/min/ft.
- F. Accessory Components: provide materials, required to complete and protect the waterproofing system, such as flashing, sealant, tape, separation layer, and leveling layer as recommended by the manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine conditions of substrates and other conditions under which this work is to be performed prior to commencement of waterproofing installation. Do not proceed with work until unsatisfactory conditions are corrected. Do not proceed with work until substrates have been inspected by the Project Representative.

### **3.02 INSTALLATION**

- A. Apply membranes in strict accordance with the manufacturer's instructions.
- B. Excavation support and subgrade substrates shall meet manufacturer's requirements prior to installation of waterproofing system. Use substrate preparation and repair methods that are acceptable to the manufacturer.
- C. Use manufacturer's recommended details for waterproofing that crosses moving joints in the concrete structure.
- D. Coordinate installation so that each area is made watertight at the end of the work period and before onset of inclement weather.

- E. No wheel traffic of any kind shall move directly over the membrane. Protective covering shall be acceptable to the Project Representative and manufacturer if wheel traffic is to be used.

### **3.03 WELDING OF SEAMS**

- A. Membranes that are lapped by means of welds shall be welded in accordance with the manufacturer's instructions.
- B. Welding equipment shall be provided by or approved by the manufacturer.
- C. Surfaces to be welded shall be clean and dry according to the membrane manufacturer's instructions.
- D. Check welds for continuity on a daily basis after cooling in accordance with the manufacturer's instructions.
- E. Imperfections will not be allowed within the seam area. Where imperfections occur, repair the seam or remove and replace it in accordance with the manufacturer's instructions.

### **3.04 EXTRUDED BULKHEAD INSTALLATION**

- A. Membranes that utilize cast-in-place water stops as bulkheads shall meet the following requirements:
  - 1. Bulkheads shall be located and spaced in accordance with the manufacturer's recommendations.
  - 2. Weld bulkheads such that continuity is achieved and no interruption is visible.

### **3.05 PENETRATIONS**

- A. Penetrations through the membrane for the purpose of supporting reinforcing steel or form ties will not be permitted.
- B. Install and waterproof pipe, conduit, and other utility penetrations in accordance with the manufacturer's instructions.

### **3.06 END CONDITION**

- A. Provide watertight closure to end of waterproofing system where new pump station connects to existing pump station.

### **3.07 REPAIRS**

- A. Replace or repair membrane areas showing injury due to excessive scuffing, puncture, or distress.
- B. Replace or repair defective seams.
- C. Accomplish repairs in accordance with the manufacturer's instructions.

### **3.08 INSPECTION**

- A. Obtain Project Representative inspection and acceptance of substrates and membrane prior to placement of steel, formwork, concrete, backfill, or other elements that could impair inspection or repair.
- B. Take cross section samples through completed welded seams a minimum of three times daily at locations selected by the Project Representative. Provide the samples to the Project Representative. Patch locations cut for the samples.

### **3.09 PROTECTION**

- A. Protect completed membrane waterproofing from subsequent construction activities as recommended by the manufacturer.

**END OF SECTION**

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## SECTION 07132

### HOT RUBBERIZED ASPHALT WATERPROOFING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies furnishing and installing waterproofing roofing system.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
CAN/CGSB-37.50-M89	Hot Applied, Rubberized Asphalt for Roofing and Waterproofing
ASTM D92	Standard Test for Flash and Fire Points by Cleveland Open Cup
ASTM D5329	Standard Test Methods for Sealants and Fillers, Hot-Applied for Joints and Cracks in Asphalt and Portland Cement Concrete Pavements
ASTM D3407	Standard Test Methods for Joint Sealants, Hot Poured for Concrete and Asphalt Pavements
ASTM D896	Standard Practice for Resistance of Adhesive Bonds to Chemical Reagents
ASTM E96	Standard Methods for Water Vapor Transmission of Materials
ASTM D36	Standard Method for Softening Points of Bitumen
ASTM D3583	Standard Methods for Testing, Joint Sealant, Hot Applied, Elastomeric-Type, for Portland Cement Concrete Pavements
ASTM D41	Standard Specification for Asphalt Primer used in Roofing, Dampproofing, and Waterproofing
ASTM D5457	Standard Guide for Flood Testing Horizontal Waterproofing Systems

- B. Qualifications:
1. Manufacturer: Minimum of 20 years experience in the production and sale of waterproofing systems.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Submit manufacturer's product data, installation instructions, use limitations, and manufacturer's recommendations.
- C. Samples: Submit representative samples of the following:
1. Complete waterproofing system including, but not limited to:
    - a. Fluid applied membrane.
    - b. Required insulation.
    - c. PMMA flashing.
- D. Shop Drawings: Details and installation procedures not covered by manufacturer's instructions and product data sheet.

E. Manufacturer Certification: Certify installer as trained and acceptable to manufacturer.

F. Qualifications: Project Examples.

#### **1.04 DELIVERY, STORAGE AND HANDLING**

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Protect primer, mastic, and adhesive from moisture.

C. Protect flammable materials from possible sources of ignition.

#### **1.05 PROJECT CONDITIONS**

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer.

B. Proceed with installation only when substrate construction and preparation work is complete and in a condition acceptable to the waterproofing manufacturer to receive waterproofing.

#### **1.06 WARRANTY**

A. Waterproofing system: Provide a manufacturer's written 20 year warranty for water tightness, which include labor and material upon completion of the work.

### **PART 2 PRODUCTS**

#### **2.01 ACCEPTABLE MANUFACTURERS**

A. American Hydrotech, Inc.

B. Soprema.

C. Approved Equal.

#### **2.02 MATERIALS**

A. Components shall be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

B. Waterproofing Assembly Components:

1. Membrane:

a. The rubberized asphalt membrane product shall contain an inert clay filler and crumb rubber to enable the product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application.

b. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the CGSB-37.50-M89 standard and other pertinent physical properties:

PROPERTY	TEST METHOD	REQUIREMENT
Flash point*	ASTM D-92 CGSB-37.50-M89	>500°F (>260°C)



PROPERTY	TEST METHOD	REQUIREMENT
Cone Penetration	ASTM D-5329 CGSB-37.50-M89	<110 mm @77°F (25°C) <200 mm @122°F (50°C)
Flow	ASTM D-5329 CGSB-37.50-M89	<3 mm @ 140°F (60°C)
Toughness	CGSB-37.50-M89	>5.5 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	≥0.040
Water Vapor Permeability	ASTM E-96, PROCEDURE E CGSB-37.50-M89	≤ 1.7 ng/Pa(s)M <sup>2</sup>
Water Absorption	CGSB-37.50-M89	Loss of mass ≤ 0.18 gram Gain in Mass ≤ 0.35 gram
Low Temperature Flexibility (-25°C)	CGSB-37.50-M89	No evidence of cracking
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No evidence of cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	Shall meet the penetration, flow, low-temp. flexibility, and viscosity requirements of Paragraph 6.2.8 of CGSB
Viscosity	CGSB-37.50-M89	2 to 15 seconds
Water Resistance (5 days/50°C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Softening Point	ASTM D-36	180°F (82°C) minimum
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-3407	40% minimum
Bond to Concrete	ASTM D-3583	Pass 0°F (-18°C)
Acid Resistance	ASTM D-896 Procedure 7.1 (N-8)	Pass-50% Nitric Acid -50% Sulfuric Acid
Resistance to Hydrostatic Pressure	ASTM D-08.22 Draft 2	100 psi minimum
Resistance to Salt Water	ASTM D-896 similar 20% sodium chloride sodium carbonate calcium chloride	No delamination, blistering, emulsification or deterioration
Resistance to Fertilizer	ASTM D-896 similar undiluted, 15/5/5, nitrogen/phosphorus potash	No delamination, blistering, emulsification or deterioration
Resistance to Animal Waste	3-year exposure	No deterioration
Solids Content		100%-no solvents
Shelf Life		10 years (sealed)
Specific Gravity		1.23 + .02

\*or alternatively not less than 77°F above the application temperature recommended by the manufacturer.

- c. Primer/Surface Conditioner:
    - 1) Asphaltic primer/surface conditioner for concrete surfaces meeting the requirements of ASTM D41.
  - d. Flashing/Reinforcing:
    - 1) Thermally bonded, spunlaid, nonwoven polyester fabric (standard duty) reinforcing sheet for use at horizontal surfaces except those below concrete topping slabs.
    - 2) Thermally bonded, spunlaid, nonwoven polyester fabric (standard duty) reinforcing sheet for vertical applications.
  - e. Adhesives/Sealant:
    - 1) Contact adhesive to bond elastomeric flashing together.
      - a) American Hydrotech, Inc., Splicing Cement.
      - b) Soprema, SBS Elastic Cement.
      - c) Approved Equal.
    - 2) Contact adhesive to bond elastomeric flashing to an approved substrate.
      - a) American Hydrotech, Inc., Bonding Adhesive.
      - b) Soprema, Colphene H.
      - c) Approved Equal.
    - 3) Sealant to seal elastomeric flashing seam edge.
      - a) American Hydrotech, Inc., Lap Sealant.
      - b) Soprema, Colphene H.
      - c) Approved Equal.
  - f. PMMA Flashing Membrane:
    - 1) Polymethyl methacrylate liquid resin membrane flashing system.
      - a) Siplast, Inc., Terapro VTS.
      - b) Soprema, Alsan RS 290.
      - c) Approved Equal.
- C. The waterproofing system shall include corner flashing and reinforcing at interior and exterior corners respectively.
- D. The waterproofing system shall be applied to all surfaces indicated to receive a waterproof membrane in the work order drawings including all penetrations. It shall provide a complete, uninterrupted water barrier.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine conditions of substrates and other conditions under which this work is to be performed prior to commencement of waterproofing installation. Do not proceed with work until unsatisfactory conditions are corrected. Do not proceed with work until substrates have been inspected and approved by the Project Representative, the waterproof membrane manufacturer's representative and the roofing contractor.

### **3.02 INSTALLATION**

- A. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on site periodically during waterproofing work to review installation procedures.
- B. Installer: Installation of the waterproofing membrane, flashing, protection layers, separation layers, and leveling layers shall be the responsibility of a single installer.
- C. Apply membranes in strict accordance with the manufacturer's instructions and the best industry practices.

- D. Use substrate preparation, surface conditioner and repair methods that are acceptable to the manufacturer.
- E. Use manufacturer's recommended details for waterproofing that crosses moving joints in the concrete structure.
- F. Coordinate installation so that each area is made watertight at the end of the work period and before onset of inclement weather.
- G. No wheel traffic of any kind shall move directly over the membrane. Protective covering may be acceptable to the Project Representative and manufacturer if wheel traffic is to be used.

### **3.03 INSPECTION**

- A. Obtain Project Representative and the waterproofing manufacturer's representatives acceptance of substrates and membrane prior to placement of backfill, or other elements that could impair inspection or repair.
- B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing and protecting membrane roofing but before placing overlaying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

### **3.04 PROTECTION**

- A. Protect completed membrane waterproofing from subsequent construction activities as recommended by the manufacturer.

**END OF SECTION**

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**SECTION 07190**  
**UNDER-SLAB VAPOR BARRIERS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies vapor barriers under all structural concrete slabs.

**1.02 QUALITY ASSURANCE (NOT USED)**

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product technical data including acknowledgment that products submitted meet requirements of the Specifications.
- C. Manufacturer's installation instructions.

**PART 2 PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Vapor barrier:
  - 1. Stego Industries.
  - 2. Raven Industries.
  - 3. W. R. Meadows, Inc.
  - 4. Insulation Solutions, Inc.
  - 5. Approved Equal.
- B. Vapor barrier tape: Manufacturer's standard.

**2.02 MATERIALS**

- A. Vapor barrier:
  - 1. Reinforced non-recycled polyethylene or polyolefin.
  - 2. 10-mil thick.
  - 3. Vapor transmission not exceeding 0.02 perm.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Place continuous vapor barrier below concrete foundation.
- C. Lap vapor barrier 3-inch at ends and edges of sheets and seal with vapor barrier tape.
- D. Extend to extremities of area, turn up at perimeter to form bond breaker between slab and wall. Tape in place.

- E. Cover vapor barrier immediately to avoid damage.
- F. Trim off excess material after slab is placed.

**END OF SECTION**

## SECTION 07191

### WATER REPELLENT AND ANTI-GRAFFITI COATING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specified clear water-repellent and non-sacrificial anti-graffiti coating system.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E514	Standard Test Method for Water Penetration and Leakage through Masonry.

- B. RILEM (Reunion Internationale des Laboratoires D'Essais et de Recherches sur les Materiaux et les Constructions), Commission 25-PEM:
  - 1. RILEM Test Method 11.4 Water Absorption Under Low Pressure (Pipe Method).
- C. Applicator Qualifications:
  - 1. Company specializing in work of this Section.
  - 2. Trained and approved by manufacturer as qualified to perform work of this Section.
- D. Pre-Application Testing:
  - 1. Arrange with manufacturer's authorized representative to perform testing, verifications, and inspections as necessary to determine final product use and to obtain specified Warranty.
  - 2. Apply water-repellent and anti-graffiti coatings as indicated by manufacturer's representative to inconspicuous surface as determined by the Project Representative.
  - 3. Repeat tests as needed to determine application rate based upon performance and appearance criteria.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Submit manufacturer's technical information, including instructions for handling, storing, and applying coating materials.
- C. Installer Qualifications.

##### 1.04 MOCK-UP

- A. Provide under provisions of this Section.

##### 1.05 PRODUCT DELIVERY AND STORAGE:

- A. Deliver to job site in manufacturer's container, with seals unbroken. Containers shall be properly labeled including the batch number and date of manufacture.

- B. Keep material protected from the elements and in original unopened containers to prevent contamination by foreign materials.

## **1.06 PROJECT CONDITIONS**

- A. Weather Conditions: Conform to the manufacturer's recommendations.

## **1.07 SPECIAL WARRANTY**

- A. Provide approved manufacturer's standard 5 year warranty for water repellency.

## **PART 2 PRODUCTS**

### **2.01 PRODUCTS**

- A. Water Repellent Coating for Concrete Substrates:
  - 1. Acceptable manufacturers:
    - a. Protectosil CHEM-TRETE 40VOC by Evonik Degussa Corporation.
    - b. Approved Equal.
- B. Water Repellent Coating for Masonry Substrates:
  - 1. Acceptable Manufacturers:
    - a. Protectosil CHEM-TRETE PB VOC by Evonik Degussa Corporation.
    - b. Approved Equal.
- C. Anti-Graffiti Coating:
  - 1. Acceptable Manufacturers:
    - a. Protectosil ANTIGRAFFITI by Evonik Degussa Corporation.
    - b. Approved Equal.
- D. Graffiti Remover:
  - 1. As recommended by the water repellent and anti-graffiti coating manufacturer for the application.
  - 2. Non-abrasive chemical or detergent cleaning methods using low pressure rinsing, conforming to manufacturer instructions.
  - 3. Methods requiring high pressure water application are not acceptable.
  - 4. Furnish a minimum 5 gallon container for Owner use.

### **2.02 WATER REPELLENT/ANTI-GRAFFITI COATING DESCRIPTION**

- A. Water repellent and Anti-graffiti coatings shall be a clear, waterborne penetrating fluorosilane coating system which forms a non-sacrificial, UV stable, hydrophobic structure within masonry pores that repels dirt, oils, liquid moisture, and graffiti markings.
- B. Permeability:
  - 1. Product shall maintain 80% of vapor transmission from the original wall construction when tested in accordance with ASTM E96.
  - 2. Minimum of 8 perms when tested in accordance with ASTM E96.
  - 3. Product shall allow water vapor transmission through masonry, and concrete materials sufficient to prevent milking and staining due to efflorescence and insufficient moisture vapor diffusion from treated surfaces.
- C. Water Penetration Resistance:
  - 1. Pass RILEM test for intrusion of water.
  - 2. Shall show no water leakage or dampness when tested in accordance with ASTM E514, for a period of 4 hours.



- D. Appearance: No residue, surface film, sheen, minimum darkening, and other appearance differences from original surfaces at application areas and subsequent applications, including overlapping coatings.
- E. Flammability: Not contributing to combustion or chemical off gassing due to fire exposure.
- F. Volatile Organic Compound (VOC) Emissions: Conform to South Coast Air Quality Management District (SCAQMD) Rule 1113 - Architectural Coatings, Amended July 13, 2007 and as accepted by authorities having jurisdiction. Maximum 100 grams per liter.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with the Applicator present, for compliance with coating application requirements and conditions affecting coating performance.
- B. Proceed with application only after unsatisfactory conditions have been corrected and surfaces receiving coating are thoroughly dry.
- C. Coordination of Work: Review other Sections to ensure compatibility of the system for various substrates.
- D. Notify the Project Representative about anticipated problems using coatings specified over substrates indicated.

### **3.02 PREPARATION**

- A. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each particular substrate condition and as specified.
- B. Surfaces shall be structurally sound, dry, clean and free of dust, dirt, grime, oils, scale, rust, silicones, curing compounds, alkali, acid residues, etc.
- C. Protect adjoining surfaces not to receive coating, including, without limitation, live plants and grass and horizontal surfaces below the application areas.

### **3.03 APPLICATION**

- A. Apply coatings to exposed surfaces indicated according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Apply materials at application rates determined by pre-application testing for each substrate. Apply a minimum of 2 coats, unless approved otherwise.
- C. Surfaces:
  - 1. Apply to exterior concrete surfaces.
  - 2. Do not apply to horizontal concrete slab surfaces.

### **3.04 FIELD QUALITY CONTROL**

- A. Manufacturer: Perform tests by manufacturer's certified technical representative.

- B. Following application, perform moisture tests to verify water repellent/anti-graffiti coating performance, as necessary to conform to the specified performance requirements.
  - 1. Use RILEM Tube Test Method to determine required repellency.
  - 2. Test several different locations including head joints and bed joints.
  - 3. Verify required coverage with that required by Field Sample results.

### **3.05 CLEANUP AND PROTECTION**

- A. During process of work, remove discarded coating materials, rubbish, cans, and rags at end of each workday.
- B. Protect work of other trades, whether to be coated or not, against damage by coating and finish work. Correct any damage by cleaning, repairing or replacing, and recoating, as acceptable to Project Representative.

**END OF SECTION**

**SECTION 07210**  
**BUILDING INSULATION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies thermal insulation: rigid board, glass fiber, and mineral batt.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C578	Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Manufacturer's data showing compliance with the specified products and special storage, handling, and installation instructions.

**1.04 DELIVERY, STORAGE AND HANDLING**

- A. Clearly identify manufacturer, contents, brand name, and R-value on each package.
- B. Store insulation materials off ground in a completely dry location. Protect against weather, condensation, and damage.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. All products shall contain no asbestos.

**2.02 INSULATION**

- A. Unfaced Fiberglass Batt and Blanket Insulation: ASTM C665, Type I; preformed unfaced glass fiber roll; flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with ASTM E84; oversize widths for friction-fit between metal framing; density to provide the R values as indicated; GreenGuard Indoor Air Quality Certified.
- B. Extruded Polystyrene:
1. ASTM C578 Type IV.
  2. Flame spread: less than 25 when tested per ASTM E84.
  3. R-Value and widths as indicated in the Drawings.

4. Acceptable manufacturer:
  - a. Dow Chemical Co. Styrofoam SM.
  - b. UC Industries Foamular.
  - c. Approved Equal.
- C. Interior Mineral Wool Insulation:
  1. ASTM C612 type IVA, or ASTM C665 type III class A Category I.
  2. Foil facing with a flame spread of 25 or less when tested in accordance with ASTM E84.
  3. R-Value and widths as indicated in the Drawings.
  4. Acceptable manufacturer:
    - a. VersaBaord 40 by Thermafiber Wabash, IN.
    - b. RockBoard 40 by Roxul.
    - c. Approved Equal.
- D. Exterior Mineral Wool Insulation:
  1. ASTM C612 type IB; CAN/ULC S702-97 type 1.
  2. R-Value and widths as indicated in the Drawings.
  3. Acceptable manufacturer:
    - a. RainBarrier 45 by Thermafiber Wabash, IN.
    - b. Cavity Rock DD by Roxul.
    - c. Approved Equal.

## **2.03 MINERAL FIREPROOFING AND SAFING**

- A. Mineral Fiber: non-combustible, ASTM C665 Type I, Class A.
- B. Density: 4 pounds per cubic foot.

## **2.04 ADHESIVE**

- A. Adhesive for rigid board insulation shall be a system approved by the board manufacturer for the underlying substrate.
- B. Bond strength shall be 80-psi min on masonry when tested in accordance with ASTM D897.

## **2.05 ACCESSORIES**

- A. Separate Vapor Retarder System:
  1. Vapor Retarder Membrane: CertainTeed "Membrain" or Approved Equal; 2 mils thick, nylon vapor retarder, with permeance rating of 1 perm per dry cup method and 10 perms with wet cup method. Flame spread of 25 or less and a smoke developed of 50 or less when tested in accordance with ASTM E84.
  2. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
  3. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

## **2.06 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive adhesive.

### **3.02 INSTALLATION**

- A. Rigid Insulation:
  - 1. Cut to fit neatly together and around corners. Butt joints tightly together.
  - 2. Apply adhesive to clean dry surface in quantities called for by manufacturer.
  - 3. Where thicker than 1-1/2 inches, install 2 layers of boards, staggering all joints six inches minimum.
- B. Batt Insulation:
  - 1. Batt insulation shall be in width suitable for tight installation. Install without gaps or voids.
  - 2. Cut in practical lengths and secure neatly to construction.
  - 3. Install with vapor barrier facing warm side.
  - 4. Tape edges where they abut.
  - 5. Replace insulation, which has damage to the facing.
- C. Mineral Fireproofing and Safing:
  - 1. Locate where indicated in the Drawings.
  - 2. Locate in openings in floors and walls, to completely seal without voids around pipe, conduit, duct, and other penetrations.
  - 3. Install in accordance with manufacturer's recommendations.

### **3.03 VAPOR BARRIER**

- A. Make vapor barrier so as to adhere with double stick foam tape.

### **3.04 INSPECTION**

- A. Do not cover Insulation installations until inspected by the Project Representative.

**END OF SECTION**

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**SECTION 07221**  
**ROOF INSULATION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies roof insulation.

**1.02 QUALITY ASSURANCE**

- A. General: Roof decks shall be reviewed and inspected by the Project Representative prior to installation of any roof insulation component.
- B. Qualification of Installers: Installation of insulation system shall be done only by competent and skilled installers, completely familiar with the products and the manufacturer's currently recommended methods of installation.
- C. Pre-Installation Examination: Before insulation application begins, examine the roof deck to determine its suitability. Any defects shall be corrected before proceeding.
- D. Affidavit: Upon completion of the insulation and before any work on the final roof coating, furnish an affidavit from the roofing manufacturer who will provide the bonded roof over the insulation stating that all roof deck insulation has been applied in the quantities specified and laid correctly according to these specifications so that the roofing warranty shall not be compromised by any later claim that roof deck insulation materials or workmanship were inadequate. The affidavit shall be signed by an officer of the roofing manufacturer and notarized, and then countersigned by the Contractor and the insulation applicator.

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Shop drawings, manufacturer's literature, including installation instructions, and product specifications.

**1.04 DELIVERY AND STORAGE**

- A. All material shall be delivered to the job Site in unopened individual units bearing manufacturer's identification of type and quality. Insulation shall be delivered dry and kept in a dry condition at the site until used.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. All insulation components shall be compatible with each other and with the roof membrane used.

## **2.02 TAPERED ROOF INSULATION**

- A. Tapered roof insulation shall be Isocyanurate board with asphalt paper top surface conforming to Fed. Spec. HHI-1972/GEN, HHI-1972/2. Aged R-value shall meet R.I.C. TIMA TECH bulletin 281-1. All insulation pieces will be tapered to achieve slopes indicated in the Drawings, minimum slope 1/2 inch per foot, and 1/2 inch per foot at crickets. The minimum thickness shall be 1/2 inch. All pieces shall be numbered as to their respective locations on the roof.

## **2.03 ROOF INSULATION**

- A. Roof insulation in areas requiring insulation of uniform thickness shall be urethane or modified isocyanurate conforming to FEDSPEC HH-I-530A, Type 1, two pounds per cubic foot. Aged R-value shall be 7.7 per inch.

## **2.04 RELATED MATERIALS**

- A. Vapor barrier shall be 1-ply fiberglass felt conforming to ASTM D2178, Type I, or polyethylene sheet laminated between plies of reinforced Kraft paper.
- B. Vapor barrier shall have a vapor permeance rating of less than 0.5 perm when tested in accordance with ASTM E96, Procedure A, and shall be resistant to puncture, abrasion and testing.

## **2.05 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

# **PART 3 EXECUTION**

## **3.01 DECK**

- A. Contractor is responsible for providing the deck in clean, smooth and dry condition to receive insulation.

## **3.02 INSTALLATION**

- A. Install vapor barrier by solid mopping barrier to asphalt primed and glazed concrete deck.
- B. Roof insulation shall be installed as two layers. Lay out joints to stagger with tapered insulation.
- C. Cricketts as shown shall be furnished as an integral single layer system with no cutting or special precautions required except for correct placement. When furnished as individual "saddle" water diverters, the installation procedures are the same as with the typical tapered insulation system.
- D. In areas to receive insulation, lay boards over vapor barrier with tight joints. Scribe to fit tightly around curbs and penetrations.
- E. Lay tapered insulation in place making modifications required for roof drain sumps and to fit around curbs and penetrations.



### **3.03 WATER CUTOFF**

- A. No more insulation shall be laid than can be covered in 1 day. Insulation work shall be closely coordinated with roof membrane application to protect insulation from water damage. Insulation shall be place in conformance with manufacturer's instructions.
  - 1. Strip edges with 12" wide ply sheet embedded completely in alternate uniform courses of specified interplay adhesive.
- B. Install "deadman" insulation filler at insulation staggers.
- C. Extend roofing plys a minimum of 12 inches onto prepared area of adjacent roofing. Embed plies into specified interplay adhesive.
- D. At beginning of next day's work, remove temporary connection. Remove "deadman" fillers. Overlap previous day's work 24 inches.

**END OF SECTION**

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## SECTION 07272

### FLUID APPLIED AIR BARRIER SYSTEM

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
  - 1. Fluid-applied vapor permeable air barrier system at exterior envelope construction with conditioned space behind.
  - 2. Sealant and fluid applied membrane flashing systems required to seal joints and penetrations to form a continuous air barrier assembly.
  - 3. Related air barrier accessories and components.
  - 4. Flexible flashing membrane at base of wall between air barrier and below grade waterproofing.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C661	Standard Test Method for Indentation Hardness of Elastomeric- Type Sealants by Means of a Durometer
ASTM C794	Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
ASTM D1781	Standard Test Method for Climbing Drum Peel for Adhesives
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E162	02a Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
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
ASTM E547	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
ASTM E2178	Standard Test Method for Air Permeance of Building Materials

- B. Pre-Installation Conferences:
  - 1. Air Barrier Pre-Installation Conference:
    - a. Administer pre-installation conference in accordance with Section 01200.
    - b. Discuss air barrier components and sequence of installation.
    - c. Discuss joints; penetrations and methods for sealing.
    - d. Identify and discuss special conditions.
- C. Mock-up:
  - 1. Provide mock-up in accordance with this Section.
  - 2. Prior to installation of the weather and air barrier system a field-constructed mock-up shall be applied to verify details and tie-ins, to demonstrate the required quality of materials and installation.

3. Construct a typical exterior wall section, 2438mm (8 feet) long and 2438mm (8 feet) wide, incorporating back-up wall, cladding, window, door frame, sill, penetrations, insulation, flashing and any other critical junction.
4. Allow 72 hours for inspection and testing of mock-up before proceeding with weather and air barrier work.
5. Received undamaged mock-up may remain as part of the Work.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Catalog cuts and installation instructions for specified manufactured products.

### **1.04 DEFINITIONS**

- A. Air Barrier System: Airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure.

### **1.05 SYSTEM DESCRIPTION**

- A. Voids within air barrier systems shall be closed to resist air flow across the assembly.
- B. Air Barrier Performance Requirement (Entire Building Envelope): The air leakage of the entire building shall not exceed 0.4 cfm/ft<sup>2</sup> under a pressure differential of 0.3 in. water (1.57psf) (2.0 L/s.m<sup>2</sup> @ 75 Pa) when tested according to ASTM E 779.
- C. The following elements provided under the work of other Sections shall be considered integral parts of the air barrier assembly:
  1. Concrete foundation.
  2. Roof vapor retarder and roof membrane.
  3. Exterior windows and door assemblies.
- D. For the Work of this Section, air barrier systems shall consist of the following:
  1. Liquid applied air barrier membrane applied over exterior gypsum sheathing surfaces, backside of precast concrete surfaces, and concrete masonry surfaces as indicated.
  2. Connections to adjacent construction, including foundation and roof vapor retarder membrane.
  3. Sealing of penetrations in the building exterior building air barrier envelope, including windows, doors, plumbing elements, electrical elements, and mechanical components, including duct penetrations at rooftop mechanical unit.

## **PART 2 PRODUCTS**

### **2.01 APPROVED SYSTEM**

- A. Acceptable Manufacturers:
  1. Pro-So-Co "R-Guard".
  2. Barritech VP by Carlisle Coatings and Waterproofing.
  3. Enershield HP by BASF.
  4. Approved Equal.

## 2.02 MATERIALS

### A. Fluid Applied Air Barrier Membrane:

1. Basis of Design Product: Pro-So-Co R-Guard Cat 5, or Approved Equal.
2. Description: Seamless, fluid applied, single component, vapor-permeable, elastomeric, acrylic membrane designed for application to exterior above-grade walls to seal assemblies and prevent moisture and air infiltration.
3. Characteristics:
  - a. Air infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E2178 or ASTM E283.
  - b. Water vapor permeability: Minimum 10.5 perms when tested in accord with ASTM E96.
  - c. Structural performance: Weather and air barrier system shall withstand positive and negative wind pressure loading when tested in accord with ASTM E330.
  - d. Water penetration (static pressure): No uncontrolled water penetration when tested in accord with ASTM E331, with differential static pressure not less than 298.8 N/mm<sup>2</sup> (6.24 psf).
  - e. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accord with ASTM D547.
  - f. Hardness: Shore A, 20-25 when tested in accord with ASTM C661.
  - g. Tensile strength: 103 x10<sup>-3</sup> N/mm<sup>2</sup> (15 psi) or exceeds strength of substrate when tested in accordance with ASTM C297.
  - h. Elongation at break: 300% when tested in accordance with ASTM D412.
  - i. Peel strength: 30 pli when tested in accordance with ASTM D1781 or C794.
  - j. Volatile organic content (VOC): 15 g/L or less.

### B. Fluid Applied Flashing Membrane:

1. Basis of Design Product: Pro-So-Co "R-Guard Fast Flash" or Approved Equal.
2. Description: 99% solids, roll/trowel/brush-applied, elastomeric liquid flashing material.
3. Thickness: Minimum 12 mils.
4. Water vapor permeability: Minimum 14 perms when tested in accord with ASTM E96.
5. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accord with ASTM E547.
6. Hardness: Shore A, 40-45 when tested in accord with ASTM C661.
7. Tensile strength: 1241 x10<sup>-3</sup> N/mm<sup>2</sup> (180 psi) when tested in accord with ASTM D412.
8. Elongation at break: 400% when tested in accord with ASTM D412.
9. Peel strength: 25 pli when tested in accord with ASTM D1781.
10. Volatile organic content (VOC): 30 g/L.

### C. Fiber Reinforced Joint and Seam Filler:

1. Basis of Design Product: Pro-So-Co "R -Guard Joint & Seam Filler," or Approved Equal.
2. Description: Waterproof, high modulus, single-component fiber reinforced joint and seam treatment and filler for application to joints, gaps and seams of sheathing and fenestration substrates.
3. Characteristics:
  - a. Hardness: Shore A, 45-50 when tested in accord with ASTM C661.
  - b. Tensile strength: 1,551 x10<sup>-3</sup> N/mm<sup>2</sup> (225 psi) when tested in accord with ASTM D412.
  - c. Lap shear strength: 1,896 x10<sup>-3</sup> N/mm<sup>2</sup> (275 psi) when tested in accord with ASTM D1002.
  - d. Elongation at break: 275% when tested in accord with ASTM D412.
  - e. Peel strength: 30 pli when tested in accord with ASTM D1781.
  - f. Volatile organic content (VOC): 15 g/L.
  - g. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.

### D. Air Barrier Sealant:

1. Basis of Design Product: Pro-So-Co R-Guard "AirDam," or Approved Equal.
2. Description: 99% solids, one-component, low-modulus, elastomeric, paintable, silyl-terminated polyether sealant.

3. Characteristics:
  - a. Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
  - b. Tensile strength:  $758 \times 10^{-3} \text{ N/mm}^2$  (110 psi) when tested in accord with ASTM D412.
  - c. Elongation at break: 1300% when tested in accord with ASTM D412.
  - d. Peel strength: 30 pli when tested in accord with ASTM D1781.
  - e. Type: Type S, Grade NS, Class 50 when tested in accord with ASTM C920.
  - f. Volatile organic content (VOC): 15 g/L.
- E. Gypsum Edge Primer:
  1. Basis of Design Product: Pr-So-Co . R-GUARD "GypPrime, or Approved Equal.
  2. Primer to consolidates and seal the cut edges of exposed gypsum sheathing surfaces to receive fluid applied air barrier.
  3. Volatile organic content (VOC): less than 100 g/L.
- F. Backer Rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth.
- G. Silicone Transition Membrane:
  1. Basis of Design Product: Pro-So-Co "SureSpan EX," or Approved Equal.
  2. Description: Extruded pre-cured silicone membrane transition between aluminum framed glazing systems and adjacent air barrier assemblies.
- H. Flexible Flashing:
  1. Modified asphalt or butyl based self adhering sheet flashing; minimum 40 mil thickness
  2. Compatible with liquid applied air barrier system.
  3. Provide manufacturer's recommended mastics for sealing of penetrations.
  4. Primer: as recommended by the flexible flashing manufacturer for the application.

## 2.03 ACCESSORIES

- A. Provide surface conditioners, primers, mastic, tape, and other accessories as specified by or acceptable to the manufacturer of each product.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### 3.02 PREPARATION

- A. Surfaces shall be sound, dry or damp, clean and free of oil, grease, dirt, excess mortar or other contaminants.
- B. Concrete and Masonry Surfaces:
  1. Fill spalled areas in concrete substrates to provide an even plane.
  2. Mortar joints in concrete block and form tie holes/voids in poured concrete shall be filled flush and smooth and allowed to cure for a minimum of 24 hours.

3. Cracks in masonry and concrete up to 6mm (1/4 inch) wide shall be filled with a trowel application of liquid applied air barrier membrane and allowed to cure overnight prior to the application of the liquid membrane to the surface, alternatively, the cracks may be sealed with a strip of sheet transition membrane applied to the substrate.
  4. Cracks in masonry and concrete wider than 6mm (1/4 inch) wide shall be sealed with a strip of liquid applied air barrier membrane supported by a mechanically fastened stainless steel flashing to bridge the gap and the membrane lapped a minimum of 76.2 mm (3 inches) on both sides of the flashing.
- C. Exterior Sheathing:
1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened.
  2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, fastened and spotted with Joint & Seam Filler and fastened into solid backing.
  3. Fill sheathing end and prime edge joints with gypsum edge primer as herein specified.
  4. Joints between panels of exterior grade gypsum board up to 6mm (1/4 inch) wide shall be filled with a trowel application of liquid applied air barrier membrane and reinforced with a 50.8mm (2 inch) wide strip of glass fiber tape or sealed with sheet transition membrane prior to the application of liquid membrane.
  5. Joints between gypsum sheathing panels and adjacent construction greater than 1/4 inch wide shall be sealed with sheet transition membrane supported by mechanically-fastened stainless steel flashing to bridge the gap and the membrane lapped a minimum of 3 inches on both sides of the flashing prior to the application of liquid membrane.
- D. Flexible Flashing:
1. Apply primer to surfaces and install flexible flashing at below grade portions of concrete foundation walls where precast panels are installed in front of the wall.
  2. Install in accordance with manufacturer's recommendations.
  3. Lap joints and run the flexible flashing down the face of the concrete foundations wall as necessary to integrate with bentonite waterproofing. Coordinate with the installation of the installer of the bentonite waterproofing to create a continuous waterproof barrier.
  4. Run the flexible flashing up the curb or wall as necessary to align with the fluid applied air barrier installed to the backside of the precast panels. Seal the joint between the flexible flashing and the air barrier on the precast to form an airtight seal.

### **3.03 JOINT AND SEAM FILLER**

- A. Apply joint and seam filler at, joints, cracks, gaps, and primed rough gypsum sheathing edges, including the following:
1. Cracks and joints larger than 12mm (1/2 inch).
  2. Fill surface defects and over driven fasteners.
- B. Apply in accordance with manufacturer's recommendations.
- C. Tool as necessary to direct water away from the building.
- D. Allow to skin before installing other air barrier components.

### **3.04 FLUID APPLIED FLASHING MEMBRANE**

- A. Apply air barrier liquid flashing membrane at expansion joints, penetrations through wall substrate and at rough openings for windows, doors, louvers and other openings in exterior wall construction, and at transitions to adjacent construction.

- B. Spread liquid flashing to create a monolithic flashing membrane extending a minimum of 50.8mm (2 inches) at upturned vertical surfaces and a minimum of 25.4mm (1 inch) at downturned vertical surfaces. Apply additional product as needed to achieve a void and pinhole free surface.
- C. Allow treated surfaces to skin before installing other air barrier components.

### **3.05 FLUID APPLIED AIR BARRIER MEMBRANE**

- A. Apply fluid applied air barrier membrane continuously over exterior substrate surfaces in accordance with the manufacturer's recommendations.
- B. Apply to the manufacturer's recommended thickness.
- C. After transition membrane areas are installed, trowel, or brush a complete and continuous unbroken film of liquid membrane at an average dry film thickness of 31mm (12 mils). Overlap transition membrane a minimum of 25.4mm (1 inch). Apply around projections ensuring a complete and continuous air seal.

### **3.06 AIR BARRIER SEALANT**

- A. Install air barrier sealant with professional grade caulking gun in continuous beads without air gaps or air pockets.
- B. Apply to a clean, dry or damp surfaces.
- C. Install backer rod: Provide size and shape of rod to control joint depth, for a width to depth ratio of 2:1.
- D. Install air barrier sealant to provide uniform, continuous ribbons without gaps or air pockets, with complete wetting of the joint bond surfaces.
- E. Tool sealant immediately to ensure complete wetting of joint bond surface and to produce a smooth, concave joint profile flush with the edges of the adjacent surfaces. Where horizontal and vertical surfaces meet, tool sealant to create a slight cove so as to not trap moisture or debris.
- F. Do not allow materials to overflow onto adjacent surfaces. Prevent staining of adjacent surfaces.
- G. Remove excess and misplaced materials as work progresses. Clean the adjoining surfaces to remove misplaced materials, without damage to adjacent surfaces or finishes.

### **3.07 FIELD QUALITY CONTROL**

- A. Field inspection and testing shall be performed in accordance with the requirements specified in Section 01410.

### **3.08 PROTECTION OF FINISHED WORK**

- A. Cover as soon as possible. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and at protrusions according to air barrier manufacturer's written instructions.

**END OF SECTION**



**SECTION 07410**  
**SHEET METAL SIDING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies:
1. Corrugated sheet metal siding (MP-1).
  2. Related spacer clips and furring.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A653	Steel Sheet, Zinc Coated, (Galvanized), or Zinc- Iron Alloy Coated by the Hot Dip Process.
ASTM B117	Standard Practice for Operating Salt Spray Apparatus.
SMACNA	Architectural Sheet Metal Manual, Current Edition.

- B. Installer Qualifications: Engage an experienced installer who has completed metal wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Panel structural properties shall be determined in accordance with latest edition of American Iron and Steel Institute's "Cold Formed Steel Design Manual," using "effective width" concepts.

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.
- C. Performance Requirements:
1. Structural Performance: Provide manufactured wall panel assemblies capable of withstanding design wind loads indicated under in-service conditions with deflection no greater than the following, in accordance with ASTM E 330.
    - a. Maximum Deflection: 1/180 of the span.
  2. Thermal Performance: Systems shall accommodate expansion and contraction caused by an ambient temperature range of minus 40 degrees F. to 180 degrees F. without detrimental effects to components, sealing systems, and surrounding construction.
- D. Shop drawings: Show layouts of panels, details of corner conditions, joints, panel profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled Work.

- E. Samples: Submit sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Handling: Exercise care in unloading, storing, and erecting wall panels to prevent bending, warping, twisting, and surface damage.
- B. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

#### **1.05 PROJECT CONDITIONS**

- A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### **PART 2 PRODUCTS**

#### **2.01 SHEET METAL SIDING SYSTEMS**

- A. Corrugated Metal Siding (MP-1):
  - 1. Description: Rolled sinusoidal ("S") shaped corrugated metal panel; 7/8 inch deep; exposed fastening system.
  - 2. Acceptable Manufacturers:
    - a. Nu-Wave by AEP Span.
    - b. C-37-7/8" by Morin a Kingspan Company.
    - c. 7/8" Corrugated Roof by Metal Sales Manufacturing Corporation.
    - d. Approved Equal.

#### **2.02 SHEET MATERIALS**

- A. Galvanized Steel Sheet: 20 gage core steel with ASTM A653 G90 galvanized coating; flat surface.
- B. Factory Finish:
  - 1. Minimum 70 percent resin Kynar 500 or Hylar 5000 fluoropolymer system complying with AAMA 2605; color to match AEP Span "Vintage."

#### **2.03 MISCELLANEOUS MATERIALS**

- A. Spacer Clips: Pultruded fiberglass spacers similar to the Cascadia Clip by Cascadia Windows and Doors or Approved Equal.
- B. Metal Furring: Minimum 16 gage; aluminum-zinc alloy-coated steel; configurations as indicated.
- C. Fasteners:
  - 1. Siding Screws:
    - a. Steel self drilling hex head screws with EPDM or neoprene sealing washers.
    - b. Organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
    - c. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.

2. Furring and Spacer Clip Screws:
  - a. Steel self drilling screws; wafer head; sufficient length to penetrate a minimum of 1/4 inch or 3 threads into metal framing.
  - b. Organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
3. Spacer Clip Screws:
  - a. Coated steel screws suitable for wood; wafer head; sufficient length to penetrate through the sheathing and a minimum of 1 inch into framing supports.
  - b. Organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
- D. Accessories:
  1. Unless otherwise specified, provide components required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
  2. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or cross-linked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
  3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant as recommended by panel manufacturer.

## **2.04 FABRICATION**

- A. Shop fabricate sheet metal components to greatest extent possible.
- B. Fabricate from prefinished steel sheet unless specified otherwise.
- C. Fabricate sheet metal trim, copings, fascia, gutters, sills, flashings from sheet material matching MP-
  1. Conform to applicable fabrication requirements specified in Section 07620.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where Work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Coordinate installation of metal siding systems with the installation of air barrier systems, flashing, trim, other adjoining work to provide a leak proof, secure, and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

- C. Metal Furring:
  - 1. Space vertical furring members as necessary to align with panel joints and as necessary to receive fasteners within the field of the panel.
  - 2. Screw fasten vertical furring to horizontal furring at each cross point.
  - 3. Provide inverted hat channel members at vertical panel joint lines; Z furring at concealed locations.
  - 4. Provide a uniform gap between each furring section as necessary to accommodate thermal movement of the panel as recommended by the panel manufacturer.

### **3.03 PANEL INSTALLATION**

- A. Install metal siding and related flashing and sheet metal in accordance with the received shop drawings.
- B. Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- C. Field cuts shall be shear cut, unless approved otherwise.
- D. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.
- E. Continue alignment of fasters between adjacent panels and around corners.
- F. Provide continuous prefinished metal siding panels between lap joints. Splicing or piecing of panels around penetrations, notches, or irregular conditions is not allowed. Coordinate interface of prefinished metal siding with adjacent construction and all penetrations with affected trades. Review treatment of irregular conditions with Project Representative prior to installation/ fabrication.
- G. At exterior walls that engage overhead corrugated metal decking, provide sheet metal closures custom cut to fit the fluted of the metal deck.
- H. Provide isolation of dissimilar metals.
- I. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### **3.04 CLEANING AND PROTECTING**

- A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

### **END OF SECTION**

**SECTION 07420**  
**PLASTIC WALL PANELS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies:
1. Exterior polycarbonate wall panel system.
  2. Integrated gate assembly.
  3. Associated flashings, trims, and accessories.
  4. Structural design of translucent panel system, including anchorage to adjacent construction.
  5. Sliding polycarbonate door system.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

Reference	Title
ASTM D3935	Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material
ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate.
ASTM B221	Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
SMACNA	Sheet Metal and Air Conditioning Contractors National Association: Architectural Sheet Metal Manual.
ICC	International Code Council, Evaluation Service: ESR-1253
SBC	Seattle Building Code

- B. Installer Qualifications: Erection shall be by factory approved installer with a minimum five years documented experience in the installation of translucent wall panels of the type specified.
- C. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, in accordance with the requirements of this Section.
- D. Pre-installation Meeting: Conduct pre-installation meeting at site attended by Owner, Project Representative, manufacturer's technical representative, and other others affected by the Work of this Section.
1. Coordinate building framing in relation to translucent wall panel system.
- E. Regulatory Requirements: Insulated metal wall panel system shall conform to the requirements of the jurisdictional code authorities.
- F. Structural Design:
1. Structural Design of insulated metal panel systems shall be by a structural engineer licensed to practice in the State where the Project is located.
  2. Furnish calculations, engineer's stamps, drawings, and other items required by the code authorities to obtain approval of the installation.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Submit complete product data for materials and proprietary systems proposed for the Work.
- C. Acoustic Test Data: The Manufacturer shall submit acoustical performance data in the form of up-to-date ASTM E90 test reports from an independent accredited testing laboratory indicating the submitted product meets the minimum acoustic requirements.
- D. Shop drawings:
  - 1. Indicate material profile, dimensions, jointing details, furring, fastening methods, flashings, penetrations, adjacent construction, and installation details.
  - 2. Include manufacturer's installation instructions for manufactured items incorporated in work.
  - 3. Indicate flashing related to the system.
  - 4. Shop drawing shall be prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.
- E. Structural Calculations:
  - 1. Shall demonstrate conformance to the applicable codes and design requirements in the Drawings and Specifications.
  - 2. Shall include drawings which indicate the magnitude, direction and location of loads imposed to the supporting concrete slab, and any factors or combinations that apply.
  - 3. Shall be prepared, stamped, dated, and signed by a Professional Engineer registered in the state of Washington.
- F. Samples:
  - 1. Submit samples of actual panels.
  - 2. Submit one sample of panel material, of sufficient size to indicate profile and color.
  - 3. Submit minimum 6 inch long samples of each type of extrusion and connector, with finish as proposed for the Work.
- G. Quality Control Submittals:
  - 1. Certification: Submit certification that the translucent panel systems have been designed in accordance with the specified requirements.
- H. Maintenance Data: The manufacturer shall provide recommended maintenance procedures, schedule of maintenance and materials required or recommended for maintenance.
- I. Submit Installer Certificate signed by installer, certifying compliance with project qualification requirements.

### 1.04 SYSTEM DESCRIPTION

- A. Structural Design: Select components as recommended by the translucent wall panel system manufacturer to meet the following requirements.
  - 1. Wind loads: Design and size panels and furring to withstand positive and negative wind loads as indicated in the Structural Drawings with a maximum deflection of 1/180 the span.
  - 2. Seismic Design: In accordance with the requirements of the jurisdictional code authorities.
  - 3. Anchorages, supports, and inserts shall be designed to simultaneously resist vertical and lateral loads, including a contribution of 1.25 x the design wind loads.
- B. Dynamic Movement: System shall accommodate the following without damage to system components or performance.

- C. The wall panel system shall be capable of accommodating its design loads, and structural and thermal movement without buckling, failure of joint seals, undue stress on fasteners, and other detrimental effects. The system shall accommodate the following:
  - 1. Movement and deformation within the system.
  - 2. Movement and deformation of the support framing as indicated in the Structural Drawings.
- D. Under normal circumstances, systems shall not exhibit vibration harmonics, wind whistles, and noises caused by thermal movement. Under the full range of design loads and conditions, the systems shall not exhibit loosening, weakening, or fracturing of attachments or components of the system, translucent panels, sealants and joint sealants.
- E. System shall accommodate tolerances of the structure.

## **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation.
- B. Protect stored materials from heat and direct sunlight.
- C. Prevent contact with materials during storage which may cause discoloration or staining.

## **PART 2 PRODUCTS**

### **2.01 COMPONENTS**

- A. Translucent Panel System:
  - 1. Acceptable Products:
    - a. Pentaglas 12 Single Panel Translucent Glazing System, by CPI Daylighting.
    - b. Equivalent products by:
      - 1) Super Sky Products Enterprises.
      - 2) Skylights Over Texas.
    - c. Approved Equal.
  - 2. Extruded aluminum panel frames with 12mm multi cell polycarbonate panels front glazed with polycarbonate interior battens.
  - 3. Color: To match Pentaglas "Clear Matte".
  - 4. Standard and custom panel widths as indicated in the Drawings.
- B. Translucent Panel Joint System:
  - 1. Panel shall be extruded in one single formable length. Transverse connections are not acceptable.
  - 2. The panels shall be manufactured with grip-lock double tooth upstands that are integral to the unit. The upstands shall be 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is not acceptable.
  - 3. The metal H battens shall consist of 2 pieces, male/female concept with build in silicon gasket, allowing for a unitized panel assembly.
  - 4. Water Penetration: No water penetration of the panel H joint connection length at test pressure of 6.24 PSF per ASTM E-331
  - 5. Air Infiltration: In accordance with NFRC 400.
  - 6. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.
  - 7. The panel joint connection shall comply with the deflection limitation of SBC Table 1604.3 for exterior walls with flexible finishes - span/120 per ASTM E-330.
- C. Steel Support Framing: As specified in Section 05400.

- D. Integrated Gate Assembly:
  - 1. Provide integrated gate assembly as indicated in the Drawings.
  - 2. Support framing as specified in Section 05500.
  - 3. Hardware as specified in Section 08710.
- E. Sheet Metal Flashing: Prefinished steel sheet to match panel frames; minimum 22 gage.
- F. Aluminum Extrusions:
  - 1. Manufacturer's standard extrusions as required to provide a complete system in clear anodized finish.
- G. Fasteners: Stainless steel or cadmium plated steel with neoprene washers.
- H. Gaskets: Manufacturer's molded silicone gaskets.
- I. Sealant: As recommended by the manufacturer of the wall panels.

## **2.02 FABRICATION**

- A. Fabricate translucent wall panels and related components in accordance with shop drawings to fit the field conditions.
- B. Finishing: Apply in accordance with finish material manufacturer's requirements; apply strippable film for protection during shipping, fabrication and installation.
- C. Form pieces in longest practical lengths, as required to match dimensional modules indicated in the Drawings.
- D. Fabricate sheet metal flashing and trim in accordance with the requirements specified in Section 07620.

## **2.03 FINISHES**

- A. Finish for Exposed Aluminum Surfaces: AAMA AA-M31C22A41; Architectural Class I, etched, medium matte, clear anodic coating, 0.7 mil thickness.
- B. Steel Anchorages and Supports: Clean and apply rust resistant primer.
- C. Isolate aluminum from dissimilar materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work. Verify that substrate is clean and dry, that joints in sheathing are solidly supported, and that sheathing is ready for installation of sheet metal panels.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.



### **3.02 INSTALLATION**

- A. Perform translucent wall panel work as indicated and in accordance with wall panel system manufacturer's instructions.
- B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.
- C. Install each panel as a single continuous piece. Install flashings as required to preclude water penetration into system.
- D. Conceal fasteners wherever possible.
- E. Install related flashing and sheet metal in accordance with the requirements specified in Section 07620. Remove protective coverings on panels immediately after installation.
- F. Tolerances:
  - 1. Maximum variation from plane or location indicated: 1/4 inch.
  - 2. Maximum offset from true alignment between adjacent members: 1/16 inch.

### **3.03 CLEANUP**

- A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths. Always test a small area before applying to the entire area.
- B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use. Always test a small sample to validate compliance before applying to the entire glazing panels.
- C. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

**END OF SECTION**

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## **SECTION 07513**

### **MODIFIED BITUMEN ROOFING SYSTEM**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section specifies all labor, equipment and materials to install modified bitumen-roofing system over properly prepared concrete decks.

##### **1.02 QUALITY ASSURANCE**

- A. General:
  - 1. Obtain primary roofing materials from a single manufacturer. Provide secondary materials as recommended by manufacturer and warrantor of primary materials.
  - 2. Roofing materials, installation methods and workmanship shall be in strict accordance with the material manufacturer's recommendations, the latest edition of the Roofing and Waterproofing Manual, SMACNA manual, Factory Mutual, Underwriters Laboratory and ASTM standards. The most stringent standards shall apply where these are in conflict or when the requirements of the Specifications and Drawings exceed those of the manufacturer.
  - 3. Refer to Section 01014 for weather constraints. Installation of the roofing system shall not begin until all moisture has been totally dried from the roofing area.
  - 4. Refer to this Section for Post-Construction Moisture Survey and Final Inspection requirements.
  - 5. The roofing system shall be an FM Global approved system.
- B. Roofing Manufacturer/Supplier Must:
  - 1. Be an ISO 9001 registered manufacturer prior to Contract award. Manufacturer shall provide proof of ISO 9001 registration by submitting a copy of the Certificate of Registration.
  - 2. Provide a list of at least 5 projects available for inspection employing same roofing system within a 200 mile radius of the site.
- C. Qualification of Installers: Be approved by the manufacturer prior to Contract award and throughout the installation and be able to present a copy of his/her certification upon request by the Project Representative. Refer to Section 00440.
- D. Test the substrate prior to the installation of the roofing system. Using the ASTM D 4541-95 Test Method as amended herein, set a 50mm dolly in Type III asphalt at a location designated by the Project Representative. Once the asphalt adhesive is cured the calibrated Type III self-aligning Adhesion Tester shall reach a minimum of 150 psi prior to adhesive failure to assure proper adhesion to the roof deck.
- E. Any deficiencies noted during inspections shall be corrected by the Contractor and approved by the material roofing Manufacturer's Technical Representative. Refer to Section 01410.
- F. Material Samples: During the course of the work, the Project Representative shall be allowed to secure samples of the materials being used from the containers on the jobsite and submit them to an independent testing laboratory for comparison. All non-approved material installed or stored shall be removed from the construction site until it has been tested. Installed materials that do not conform to the Contract shall be removed at no additional cost to King County.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Materials:
  - 1. Submit shop drawing showing layout, details of construction including a cross section of the roofing system, and identification of materials.
  - 2. Submit tapered insulation layout identifying insulation thickness, slopes, and average R-value.
  - 3. Submit four copies of the technical data on roofing materials, including material specifications, Material Safety Data Sheets, and installation procedures. Roofing material manufacturer shall provide written verification that major roofing components, including but not limited to asphalts, coatings, cold process adhesives, roofing ply sheets, reinforcement fabric felts and mats, mastics, and sealants are all compatible with each other.
  - 4. Submit four copies of the technical data on insulation, vapor barrier/insulation envelopment membrane, sheet metal, flashings, lumber, sealants, fasteners, and skylights specified in Sections 07221, 07620, 07900 and 07800.
  - 5. Copy of material manufacturer's 10-Year labor and material warranty.
- C. Copy of material manufacturer's ISO 9001 Certificate of Registration.
- D. List of material manufacturer's qualifying projects.
- E. Warranty.
- F. Testing samples.

### **1.04 REGULATORY REQUIREMENTS**

- A. 2012 Seattle Building Code.
- B. FM Global 4470 approved materials using FM 1-90 for Wind Uplift.
- C. Underwriters Laboratories, Inc. "Class A Roofing System".
- D. NFPA 820, Fire Protection in Wastewater Treatment and Collection Facilities, refer to Section 01063.

### **1.05 FIELD QUALITY CONTROL**

- A. Manufacturer's Responsibilities: In addition to the field inspection requirements during construction, the manufacturer's technical representative shall be available within 24 hours notice during the entire course of the project for site inspection and consultation.
- B. Contractor's Responsibilities:
  - 1. A thermometer shall be installed and working on the asphalt kettle; a second thermometer shall be available on the kettle discharge at the roof to ensure that all manufacturer's temperature requirements are within required tolerances.
  - 2. Cut and patch roof cores as directed by the Project Representative for the Post-Construction Moisture Survey and Final Inspection. When the Post-Construction Moisture Survey and Final Inspection disclose material deficiency or wetness, correct deficiencies in accordance with manufacturer's instructions and this Section.

## **1.06 FIRE AND SMOKE PROTECTION**

- A. Kettles shall be located so as to prevent damage or the entrance of fumes to buildings or other property. They shall not be positioned on roof decks. Mops shall be spun at the end of work periods to separate the strands and shall be stored in that condition to prevent spontaneous combustion. Fire extinguishers shall be provided near kettles for immediate use. Refer to Section 01063.

## **1.07 SAFETY PRECAUTIONS**

- A. All King County and OSHA safety rules shall be adhered to in the execution of this work. The fumes of hot bituminous materials may be toxic to some workers. Adequate protection shall be provided, to prevent burns and skin irritation, in accordance with building owner safety requirements and Contractor's Accident Prevention Program (APP) and Health and Safety Plan (HASP).
- B. Refer to NFPA 820, Fire Protection in Wastewater Treatment and Collection Facilities, and to Section 01063.

## **1.08 ROOF TRAFFIC**

- A. After work on roof is started, no traffic will be permitted on the roof other than that necessary for the roofing application and inspection. Materials shall not be piled on the roof to the extent that design live loads are exceeded. Roofing materials shall not be transported over unfinished or finished roofing or existing roofs unless adequate protection is provided.
- B. Any damage to existing roofs shall be repaired as directed by Project Representative and at no expense to the County.

## **1.09 PROTECTION AGAINST SOILAGE**

- A. Surface of walls, walks, pavements, adjacent property, etc. shall be protected as necessary to prevent soiling or other damage resulting from the application of roofing or transporting of materials. If surfaces are stained or damaged in any way, they shall be restored by the Contractor at no cost to the County, in a manner acceptable to the Project Representative.
- B. Felt envelopes shall be installed where required to prevent bitumen drippage. Refer to NRCA manual for felt enveloping techniques.

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

- A. Materials shall be delivered to the site in new, dry, and unopened containers showing product name and manufacturer's name. Materials shall be delivered in sufficient quantity to allow continuity of work. Material received which is wet or is otherwise damaged shall be rejected.
- B. Any material which indicates 20% or greater (Wood Scale) moisture content on a Delmhorst moisture meter or is damp to the touch shall be deemed wet.
- C. Storage shall be either in a heated building or in a warehouse or similar type structure at ambient temperature and humidity. Conditions shall be such that the moisture content of felts at time of use does not exceed the equilibrium moisture content (EMC) at 75% RH.

- D. Storage under polyethylene or similar non-breathing film stock shall not be permitted. Rolls of flashing and felts shall be stacked on their ends and never in contact with the ground. Remove plastic packaging shrouds from insulation. For felt rolls, slit the top of the plastic shrink wrap only. Cover top and sides of all stored materials with a properly secured tarpaulin. Discard rolls which have been flattened, creased, or otherwise damaged. Store roll goods on level pallets. Do not stack pallets. Bituminous emulsions and materials marked "KEEP FROM FREEZING" shall be stored in areas where temperatures will remain above 40°F (5°C).
- E. Proper storage on or off the site shall be the responsibility of the roofing Contractor. Cover all materials when Project is not in progress and maintain the ability at all times to cover the materials when required.
- F. Any unused roofing felt remaining on the roof at the end of the workday shall be returned to storage. Materials shall be handled in a manner to avoid bending, tearing, or other damage during transportation and installation. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing.

### **1.11 WARRANTY INSPECTION**

- A. Upon completion, inspections shall be made by all parties to ascertain that the roofing system has been installed according to the roofing system warrantor's published specifications and details.

### **1.12 ROOFING WARRANTY**

- A. 10-Year single-source labor and material warranty provided by the roofing material manufacturer shall cover all roof-related components installed under this Section and shall not be limited to only those materials supplied by the manufacturer issuing the warranty. This includes insulation, fasteners, membranes, base flashings, and sheet metal. If the manufacturer is a subsidiary company, the warranty shall be issued by the parent company. Warranty shall cover wind speeds up to and including 70 MPH. Wind speeds shall be based on National Weather Service Data from Seattle-Tacoma International Airport. The warranty shall not include routine roof inspection or maintenance services. The material manufacturer shall issue the warranty effective upon the date of Final Acceptance.

### **1.13 POST-CONSTRUCTION MOISTURE SURVEY AND FINAL INSPECTION**

- A. Conduct Post-Construction Moisture Survey and Final Inspection not sooner than 30 days after the manufacturer submits their warranty but prior to Final Acceptance of the roof.
- B. Refer to this Section for Post-Construction Moisture Survey and Final Inspection procedure.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Comply with Quality Control, References, Specification and Manufacturer's data. Where conflict may exist, requirements that are more stringent govern.
- B. All components shall be products compatible with roof system and certified by the roofing material manufacturer as a single-source warranty roof system. All materials shall be certified as "asbestos free".

## 2.02 MANUFACTURERS

- A. Siplast.
- B. Soprema.
- C. Approved Equal.

## 2.03 ROOFING SYSTEM COMPONENT MATERIALS

- A. Sheet Materials:
  - 1. SBS Modified, Polyester/Fiberglass reinforced, ASTM D-4601 Type II Base Sheet, Base Flashing Ply Sheet, and vapor barrier/insulation envelopment membrane:
    - a. Parabase Plus, Siplast.
    - b. Modified Sopra-G, Soprema.
    - c. Approved Equal.

Test	Typical Value	Test Method
Thickness (avg)	47 mils min	ASTM D 4601-04
Breaking Strength @ 77°F	44 lbf/in min	ASTM D 146 or ASTM D 4601-04
Asbestos Content	0%	EPA/600/R-93/116

- B. ASTM D-2178 Type IV Fiberglass Field Ply Sheet:
  - 1. Paradiene 20, Siplast.
  - 2. Elastophene Sanded, Soprema.
  - 3. Approved Equal.

Test	Typical Value	Test Method
Tear Strength	40 lbs Min	ASTM D 6163 or ASTM D 5147
Elongation @ 73°F +/- 3.6	3% Min	ASTM D 6163 or ASTM D 5147
Dimensional Stability	<0.5 %	ASTM D 5147 or ASTM D 6164
Compound Stability Temp	215° F	ASTM D 5147 or ASTM D 6164
Asbestos Content	0%	EPA 600/M4-82-020

- C. Finish Sheet:
  - 1. Fiberglass Reinforced SBS Modified Bitumen Cap Sheet:
    - a. Parafor 30 (BW), Siplast.
    - b. Sopralene 180 FR GR (SG), Soprema.
    - c. Approved Equal.

Test	Typical Value	Test Method
Thickness, mils (mm)	90 mils min	ASTM D 6163 or ASTM D 5147
Elongation at 73.4 °F +/- 3.6	56% min	ASTM D 6163 or ASTM D 5147
Tear Strength at 73.4°F +/- 3.6	Min 73 lbf/in	ASTM D 6163 or ASTM D 5147
High Temperature Stability	215°F Min	ASTM D 6163 or ASTM D 5147

- D. Base Flashing:
  - 1. Fiberglass Reinforced SBS Modified Bitumen Cap Sheet:
    - a. Parafor 50 LT, Siplast.
    - b. Sopralene 250 FR GR, Soprema.
    - c. Approved Equal.

Test	Typical Value	Test Method
Thickness, mils (mm)	154 mils min	ASTM D 6163 or ASTM D 5147
Elongation at 73.4 °F +/- 3.6	54% min	ASTM D 6163 or ASTM D 5147
Tear Strength at 73.4°F +/- 3.6	Min 100 lbf	ASTM D 6163 or ASTM D 5147
High Temperature Stability	230°F Min	ASTM D 6163 or ASTM D 5147

E. Interply, Base Flashing, and Surfacing Adhesive, and vapor barrier/insulation envelopment membrane adhesive:

1. PA-1000 Polymer Modified Asphalt, Siplast.
2. SOPRACOLLE E, Soprema.
3. Approved Equal.

Test	Typical Value	Test Method
Softening Point	Min 88 °F	ASTM D 6152
Flash Point	260°F or greater	ASTM D 6152
Penetration @25°C	30-60 dmm	ASTM D 6152
Tensile Elongation	900% min	ASTM D 6152
Low Temperature Flexibility	Pass @ 14°F Max	ASTM D 6152
Elastic Recovery	80%	ASTM D 6152

F. Polyisocyanurate and Wood Fiber Insulation Adhesive:

1. ASTM D 6152, Type SEBS Modified Asphalt.

G. Related Roofing System Materials:

1. Asphalt Primer:

Test	Typical Value	Test Method
Asbestos Content	0%	EPA 600/M4-82-020
Viscosity	60 - 70 Ku	ASTM D 562
Specific Gravity	1.22	ASTM D 1475
Percentage Solids	38.7%	ASTM D 1644
Volatiles by Volume	75%	HRC Test

2. Fibrated Asphalt Mastic:

Test	Typical Value	Test Method
Asbestos Content	0%	EPA 600/R13/116
Density @ 77°F	9.3 lbs/gallon	ASTM D 1475
Non-Volatile Matter by Weight	80%	ASTM D 4586
Resistance to Sag	1/8", maximum	ASTM D 4586
Moisture Vapor Transmission	0.1-0.4 g/100 in <sup>2</sup> /24 Hrs. @ 0.020 in	ASTM E 398

3. Glass Reinforcing Mesh:

Test	Typical Value	Test Method
Weight	1.3 lbs./ 100 sq. ft	ASTM D 1668
Tensile (Warp and Fill Directions)	65 lbf/in., min.	ASTM D 146
Moisture Absorption	None	ASTM D 146

4. Elastomeric Sealant:

Test	Typical Value	Test Method
Tensile Strength	180 psi	ASTM D 412
Ultimate Elongation	550%	ASTM D 412
Adhesion-in-Peel	25 lbf	ASTM C 794
Hardness @ 77°F, 50% RH (Shore A)	25 +/-5	ASTM C 661
Weep & Sag	Passes	ASTM C 639
Staining	Passes	ASTM C 510
Weight-loss & cracking after aging	Passes	ASTM C 792
Durability (Bond &	Passes	ASTM C 719



Test	Typical Value	Test Method
Cohesion)		
VOC	62 g/L, max	ASTM D 3960
Asbestos Content	0%	EPA 600/R13/116

5. Cold Applied Self-Adhering Laminated Liner Under Metal Coping:
  - a. CCW WIP 300HT, Carlisle Corp.
  - b. Grace Ice & Water Shield, WR Grace & Co.
  - c. Approved Equal.

Test	Typical Value	Test Method
Thickness, Membrane	40 mil	ASTM D 3767 Method A
Tensile Strength, Membrane	250 psi	ASTM D 412 (Die C Modified)
Elongation, Membrane	250%	ASTM D 412 (Die C Modified)
Low Temperature Flexibility	Unaffected @ - 20°F	ASTM D 1970
Permeance (Max)	0.05 Perms	ASTM E 96

6. Polymethyl Methacrylate (PMMA) fleece membrane flashing system and related surface fillers and primers:
  - a. Alsan RS Flashing System, Soprema.
  - b. ParaPro, Siplast.
  - c. Approved Equal.
7. Accessory Sealing Tape for PMMA: Webseal by Eternabond, a Division of Royal Adhesives and Technologies.
8. Roofing aggregate: NOT USED.

#### H. Wood Blocking and Curbs:

1. Lumber: American Wood Protection Association (AWPA) No. 2 grade Southern Pine; free from warping and visible decay; pressure-treated according to AWPA Standard U1 for lumber and timber with copper azole, CA-B/CA-C or Standard P25-10 (SBX), to a retention of .1 lb/ft<sup>3</sup> for above ground use.
2. Lumber for wood blocking and curbs shall be 2 inches x 6 inches minimum.
3. Cedar shingles: bevel 1 inch x 6 inches.
4. Cant strips shall be ASTM C728-82, perlite, 4 inches x 4 inches cut on bias, and adhered per Section 07221.

#### I. Sustainability:

1. Sustainability Requirements: Section 01350.

## 2.04 MECHANICAL FASTENERS:

#### A. Wood to wood:

1. No. 10 coated or hot dip galvanized screw which is compatible with SBX or CA pressure treated lumber and long enough to penetrate underlay blocking 1-1/4 inches.
2. Acceptable manufacturers: Grabber Construction Products.; ITW Buildex or Approved Equal.

#### B. Wood to concrete:

1. 1/4 inch diameter, flat head anchor which is compatible with SBX or CA pressure treated lumber and long enough to provide minimum 1-1/2 inches embedment.
2. Acceptable manufacturers: Powers Fasteners, USA; ITW Buildex or Approved Equal.

#### C. Termination bars or metal channels to masonry/concrete:

1. 1/4 inch diameter, flat head anchor with EPDM washer long enough to provide 1-1/4 inch embedment minimum.

- 2. Acceptable manufacturers: Powers Fasteners, USA; ITW Buildex or Approved Equal.
- D. Roofing plies to wood:
  - 1. Nails: Spiral or annular ring shank, twelve (12) gage minimum, with integral 1 inch cap.
  - 2. Acceptable manufacturers: National Nail Corp.; Simplex Nails, Inc. or Approved Equal.
- E. Sheet Metal to Wood Blocking or metal channels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head with EPDM or PVC washer under heads of fasteners bearing on weather side of sheet metal.
- F. Sheet metal to sheet metal: High-strength aluminum or stainless-steel rivets.
- G. Drawband: Gold Seal stainless steel worm gear clamp by Murray Corporation., Power-Seal stainless steel worm drive clamp by Breeze Clamp Company or Approved Equal.
- H. Insulation: Refer to Section 07221.
- I. Sheet Metal: Refer to Section 07620.
- J. Fall Protection Skylights: Refer to Section 07800.

## **2.05 MISCELLANEOUS MATERIALS:**

- A. Walkway Pads: Bituminous, as recommended by the membrane manufacturer, minimum 1/2-inch thick.
- B. Drains: Jay R. Smith, 1850 Series; Josam 22500 Series, or Approved Equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify conditions as satisfactory to receive work.
- B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.
- C. Verify that work of other trades penetrating roof deck or requiring workers and equipment to traverse roof deck has been approved by the Project Representative and manufacturer.
- D. Check projections, curbs, and deck for inadequate anchorage, foreign material, moisture, or unevenness that would prevent quality and execution of new roofing system.

### **3.02 GENERAL WORKMANSHIP**

- A. The presence and activity of the manufacturer's representative or the Project Representative shall in no way relieve Contractor of Contract responsibilities or duties.
- B. Substrate: Free of foreign particles prior to laying roof membrane.
- C. Traffic and equipment: Kept off completed plies until adhesive has set.
- D. Wrapper and packaging materials: Not to be included in roofing system.

- E. Entrapped aggregate: Not permitted within new membrane. Its discovery is sufficient cause for rejection.
- F. Ply shall never touch ply, even at roof edges, laps, tapered edge strips, and cants.
- G. Install new base and intermediate plies two inches beyond top edge of cants.
- H. Cut out and patch 'fishmouths'/side laps which are not completely sealed. Replace all sheets which are not fully and continuously bonded.
- I. Bitumen heating and application:
  - 1. Use low burner flames during initial melt-downs, circulate modified bitumen after initial melt-down.
  - 2. Kettles shall be equipped with thermometers calibrated to indicate bitumen temperature and shall be free of any non-compatible materials.
  - 3. Maximum bitumen temperature: 25°F below the flash point.
  - 4. Application temperature shall not vary more than 25 degrees F above or below the "equiviscous" temperature (EVT). The EVT represents the ideal mop-bucket temperature for good application. Cutting or any other alteration of bitumens will not be permitted. Asphalt adhesive application shall result in approximately 30 pounds of asphalt ( $\pm$  25% on a total job average basis) per roof square.
  - 5. Avoid prolonged heating of modified bitumen at high temperatures. Reduce the modified bitumen temperature to below EVT if the modified bitumen is not being used for periods of 4 hours or more.
  - 6. Kettle: Free of contaminants, unapproved asphalt, or coal tar pitch.
  - 7. Bitumen temperatures shall be checked regularly to insure compliance with the above requirements.
  - 8. Miscellaneous Application Rates: Bitumen quantities for waterstop/tie-offs, flashings, miscellaneous detail applications, and minimum kettle capacity are not included in application rates. To account for these factors, add approximately 25 percent additional bitumen on a total-job average basis.
  - 9. Definition of roof corner and perimeter widths:
    - a. The perimeter strip is defined as the outside strip of a roof area.
    - b. Where multi-level roofs adjoin, the edge of the upper roof is a roof perimeter when the difference in height between the upper and lower roof areas is greater than 3 feet.
    - c. The corner area is defined as the overlap of perimeter strip areas.
    - d. The width of roof corners and perimeters is subject to a minimum width of 4 feet and defined as the smaller of either: 0.1 times the building lesser plan dimension; or 0.4 times the eave height.

### 3.03 PREPARATION

- A. Protection:
  - 1. Be responsible for protection of property during course of work. Lawns, shrubbery, paved areas, and building shall be protected from damage. Repair damage at no extra cost to King County.
  - 2. Provide at site prior to commencing removal of debris, a dumpster or dump truck to be located adjacent to building where directed by the Project Representative.
  - 3. Roofing, flashings, membrane repairs, and insulation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.
  - 4. At start of each work day drains within daily work area shall be plugged. Plugs to be removed at end of each work day or before arrival of inclement weather.
  - 5. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day and before arrival of inclement weather.
  - 6. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement. Move equipment and ground storage areas as work progresses.

7. Construct an enclosed chute from roof for removal of debris from roof area. Protect building surfaces at chute/set-up areas with tarpaulin. Secure tarpaulin. Remove dumpster from premises when full and empty at approved dumping or refuse area. Deliver empty dumpster to site for further use. Upon job completion, dumpster/chute shall be removed from premises. Spilled or scattered debris shall be cleaned-up immediately. Removed material to be disposed from roof as it accumulates.
8. At end of each day, ensure that all roof areas are sealed with water stops along edges to prevent water entry.
9. Provide clean plywood walkways and take other precautions required to prevent tracking of aggregate/debris from existing membrane into new work area where aggregate/debris pieces can be trapped within new roofing membrane. Instruct and supervise workers to ensure that aggregate/debris is not tracked into new work areas on workers shoes or equipment wheels. Discovery of entrapped aggregate/debris within new membrane is sufficient cause for its rejection.
10. Remove existing roofing:
  - a. Verify that roofing manufacturer's technical representative is on site.
  - b. Carefully remove existing ballast rock, membrane, and insulation to prevent damage to existing structures and equipment.
  - c. Remove counterflashing as indicated in the Drawings.
  - d. Remove flashings to substrate.
  - e. Remove perimeter edge metal as indicated in the Drawings.
  - f. Reuse all existing lumber that is suitable for use in the new roofing system.
  - g. Sweep clean roof deck.

### **3.04 CARPENTRY**

- A. Wood curb locations:
  1. Mechanically attach wood blocking to deck at all wood curb locations as indicated in the Drawings. Minimum 2 fasteners per this Section.
  2. Offset blocking layers 12 inches, weave corners. Blocking thickness shall be equal to final insulation thickness including tapered edge. Blocking width: 4 inches, nominal.
  3. Install wood cants to blocking if required in the Drawings. Nail two (2) rows staggered to horizontal and vertical substrates. Spacing in any one (1) row shall not exceed 24 inches.
- B. Wood blocking fastening pattern: Secure continuous wood blocking to substrate with mechanical fasteners attached in two (2) staggered rows at two (2) feet on center.
- C. Wood Blocking Repairs and Modifications:
  1. Reattach loose blocking; replace warped or damaged blocking. Fasten new continuous wood blocking to the substrate with a minimum of two (2) fasteners per section. Countersink fasteners flush with blocking surface.
  2. Blocking thickness: 2 inches nominal.
  3. Blocking width: Flush with edges.

### **3.05 THERMAL INSULATION**

- A. Prime existing concrete deck and vertical substrates with asphalt primer at a rate of 1 gallon per 100 sq. ft.
- B. Install vapor barrier/insulation envelopment membrane on deck, curbs, penetrations and parapets using methods described in this Section.
- C. Adhere isocyanurate insulation and wood fiber cover board insulation in solid moppings of specified hot adhesive. The asphalt shall be heated and applied in accordance with this Section.
  1. Install insulation boards in courses parallel to roof edges, mopping surface up.
  2. Firmly butt each insulation board to surrounding boards without deforming boards.

3. Offset joints of top layer 6 inches in both directions from joints of base layer.
4. Maximum elevation variation between boards at joints: 1/8 inch.
5. Cut and fit insulation boards where roof deck intersects vertical surfaces. Cut board 1/4 inch from vertical surface.
6. Immediately after placement, walk insulation boards into hot bitumen to achieve solid bond.
7. Promptly spread any bitumen pools that may accumulate on insulation surface to achieve smooth surface for roofing installation.

### **3.06 CRICKETS**

- A. Install crickets as per tapered insulation design using solid moppings of specified hot adhesive. The asphalt shall be heated and applied in accordance with this Section.
- B. Install crickets with a minimum slope of ½ inch per foot.
- C. Taper crickets to nothing.

### **3.07 PERLITE CANTS**

- A. Cant strips shall be adhered at all 90-degree angles where the horizontal installation of insulation meets the vertical sides of roof penetrations and walls using solid moppings of specified hot adhesive. Cants shall be installed prior to application of membrane and flashings.

### **3.08 ROOF SYSTEM APPLICATION**

- A. Install the following prior to application of the roofing system:
  1. Wood blocking at roof edge, curbs, and penetrations.
  2. Thermal insulation.
- B. One (1) ply of specified base sheet shall be adhered with solid moppings of specified adhesive. Beginning at low point of roof run plies parallel to ridge or high point of roof continuing to all projection bases and two inches beyond top edge of cants or as required by roofing system manufacturer. The asphalt shall be heated and applied in accordance with this Section.
- C. One (1) ply of specified interply sheet and one (1) ply of specified Finish sheet shall be adhered with solid moppings of specified adhesive. Beginning at low point of roof run plies parallel to ridge or high point of roof continuing to all projection bases and two inches beyond top edge of cants or as required by roofing system manufacturer. The asphalt shall be heated and applied in accordance with this Section.
  1. Starter sheets shall be installed to maintain a minimum 2 inch side lap and there shall be a minimum of three plies at all locations. Starter strips shall be installed according to NRCA guidelines. Place ply sheets to ensure water will flow over or parallel to, but never against exposed edges.
  2. Use minimum 19-1/2 inch wide plies to start and finish roof membrane along roof edges and terminations.
  3. Apply adhesive no more than ten (10) feet ahead of each roll being embedded. Broom ply from unmopped side before adhesive cools. Under cool weather conditions or when wind gusts exceed 15 mph, apply adhesive no more than 5 feet ahead of each roll. Ensure complete and continuous seal and contact between bitumen and ply sheets, including ends, edges, and laps without wrinkles, fish mouths, or blisters. Broom width: 34 inches minimum.
  4. Cut out and patch all fish mouths/side laps which are not completely sealed. Replace all sheets which are not fully and continuously bonded.
  5. Lap ply ends six (6) inches. Stagger end laps three (3) feet minimum. The asphalt shall be heated and applied in accordance with this Section.
  6. Fit plies into roof drain rims; install lead flashing and finishing plies per Drawings and this Section.
  7. Base Flashings shall be installed in accordance with this Section.

8. Roof is to be inspected and approved by representative from roof system warrantor before application of surfacing.
9. Install Gravel Stop as indicated in the Drawings.

### 3.09 FLASHINGS

#### A. Base Flashing to Wood Blocking and Masonry

1. Ply Sheets:
  - a. Fully adhere one (1) ply of specified base flashing completely to flashing substrate, cant, and roofing. Flashing shall extend a minimum of 8 inches above finished roof membrane and to the top of the wood curb where possible.
  - b. The asphalt shall be heated and applied in accordance with this Section.
2. Cap Sheets:
  - a. Snap a chalk line 6 inches from the toe of cant out onto roof membrane.
  - b. Measure the distance from the chalk line up the wall to where flashing will be terminated. On sloped roofs, take two measurements 39 inches apart.
  - c. Measure down the length of a roll of specified cap sheet, and cut, in cross machine direction, a section the same length. If roof is sloped, start at the bottom, and transfer height measurement to cutting of the flashing cap. Each section is 39 inches in width.
  - d. Apply section in specified adhesive using a strapping method, overlapping the exposed smooth selvage with each new section. Bottom of flashing cap shall be lined up 6 inches from toe of cant, on chalk line.
  - e. Fully adhere the flashing cap ply over base ply in specified flashing adhesive applied in accordance with this Section.
  - f. The selvage of the last section shall be cut flush to the mineral surface prior to the application, ensuring that total flashing surface is mineral surfaced.
  - g. Terminate as indicated in the Drawings and this Section.

#### B. Existing Drains:

1. Remove and clean flashing collar. Refer to retro drain manufacturer's instructions as applicable.
2. Install tapered edge strip around drain to create 48 x 48-inch sump, where possible. Miter corners. Seal top of tapered edge to drain rim with fiberglass mesh embedded between alternate courses of asphalt mastic.
3. Install multi-ply roofing or stripping plies into sump and onto drain rim.
4. Apply 1/16-inch uniformly thick layer of asphalt mastic to surface receiving lead flashing.
5. Set single piece lead flashing (30 inch square minimum) in mastic centered over drain, extend lead 6-inches beyond drain rim. Neatly dress lead with perlite taper strip.
6. Prime lead with asphalt primer.
7. Camp flashing collar to drain in bed of mastic.
8. Neatly cut lead within drain at rim.
9. Install cap sheet in the drain sumps in accordance with this Section and the Drawings.
10. Install strainer as indicated in the Drawings.

#### C. Conduit Penetrations:

1. Cut new lead jack vertically and install around penetration. Refer to this Section and the Drawings.
2. Solder side of lead jack to fit tightly around penetration.
3. Band top of lead jack using a worm gear clamp.
4. Apply specified sealant at top of lead.
5. Prime metal flange with asphalt primer and allow to dry.
6. Apply elastomeric mastic under flange and onto roof.
7. Install flange, four inches wide minimum, completely around periphery of vent flashing. Set flange into asphalt mastic.
8. Flash with three stripping plies of flashing base ply felt, 4, 8 and 12 inches larger than lead flange.

- D. Urethane-polyester fleece membrane flashing details:
  - 1. Refer to flashing system manufacturer's instructions and the Drawings.
  - 2. Locations for the urethane-polyester fleece membrane flashing include but are not necessarily limited to:
    - a. Base flashings, inside and outside corners, and turn bars.
    - b. Wall joints.
    - c. Duct penetrations.

### **3.10 SHEET METAL**

- A. Two-piece Counterflashing/Reglet:
  - 1. Install as indicated in the Drawings, manufacturer's instructions, SMACNA Manual and this Section.
- B. Perimeter Coping:
  - 1. Install Cold Applied Self-Adhering Laminated Liner as indicated in the Drawings and Manufacturer's instructions.
  - 2. Aluminum sheet metal shall not directly contact pressure treated lumber.
- C. Metal Wall Panel System:
  - 1. Refer to wall panel system manufacturer's installation instructions and shop drawings.
  - 2. General: Install metal wall panels in orientation, sizes, and locations indicated on approved shop drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components securely in place with provisions for thermal and structural movement.
  - 3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction.
  - 4. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 5. Apply elastomeric sealant as indicated or, if not indicated, as necessary for waterproofing.
  - 6. Provide weatherproof escutcheons for parapet wall penetrations.
  - 7. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
  - 8. Aluminum sheet metal shall not directly contact pressure treated lumber.
  - 9. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- D. Scuppers:
  - 1. Install as indicated in the Drawings, manufacturer's instructions, SMACNA Manual and this Section.

### **3.11 DAILY WATER STOP/TIE-INS**

- A. Remove embedded gravel/debris from top ply of felt along termination. Width: 18 inches.
- B. Install "deadman" insulation filler at insulation staggers.
- C. Extend roofing plies at least twelve inches onto prepared area of adjacent roofing. Embed plies into Specified Interply Adhesive or Asphalt Mastic. Strip edges with twelve-inch wide ply sheet embedded completely in alternate uniform courses of specified Interply Adhesive or Asphalt Mastic.
- D. At beginning of next day's work remove temporary connection by cutting felts evenly along edge of existing roof system. Remove "deadman" insulation fillers. Overlap previous day's work 24 inches.

### 3.12 WALKWAY PADS

- A. As indicated in the Drawings spot adhered using asphalt mastic.

### 3.13 SKYLIGHTS

- A. Installation shall be in accordance with manufacturer's instructions for the conditions indicated in the Drawings. Refer to Section 07800.
- B. Upon completion of the work, perform a leakage test over all surfaces of each skylight to the satisfaction of the Project Representative.
  - 1. Spray skylights with a garden type hose nozzle for a minimum period of 10 minutes.
  - 2. Trace moisture found on interior surfaces to the point of entry and repair the faulty work. Retest.
- C. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

### 3.14 POST-CONSTRUCTION MOISTURE SURVEY AND FINAL INSPECTION

- A. Moisture Survey Procedure:
  - 1. Contractor Responsibilities: Provide access to roof, make core cuts, and make all repairs at its own expense.
  - 2. King County's Responsibilities: Provide moisture survey map, determine random moisture test locations using [www.random.org](http://www.random.org), provide Delmhorst moisture meter, and take moisture readings.
  - 3. If the sum of all roof areas on a selected building is:
    - a. <2,000 SF: Map 4 roughly equal-size areas onto the roof plan and randomly select 2 areas out of the 4 to test for moisture, provided that at least one test is conducted on each separate roof area.
    - b. >2,000 SF but <10,000 SF: Map 10 roughly equal-size areas onto the roof plan and randomly select 5 areas out of the 10 to test for moisture, provided that at least one test is conducted on each separate roof area.
    - c. >10,000 SF: Map 20 roughly equal-size areas onto the roof plan and randomly select 10 areas out of the 20 to test for moisture, provided that at least one test is conducted on each separate roof area.
  - 4. The roughly equal-size areas shall be mapped onto the roof plan accordingly:
    - a. At least one test area shall be mapped onto each roof area.
    - b. Round or curved roofs shall be mapped with "pie slice" or similarly-shaped areas to achieve roughly equal-size.
  - 5. The inspector may choose the specific moisture test spot within each randomly selected test area (the spot most likely to be wet).
  - 6. 20% or greater moisture reading on a Delmhorst meter in any roof layer (base sheet, plies, insulation) or visible moisture on the deck is a positive test result and the entire test area shall be deemed wet.
  - 7. <20% moisture reading on a Delmhorst meter in all roof layers (base sheet, plies, insulation) and no visible moisture on the deck is a negative test result and the entire test area shall be deemed dry.
  - 8. For each positive moisture test the inspector will select 1 more untested roof area to test until another dry reading is taken or until all roof areas have been tested.
  - 9. Repair core cuts and restore roofing system per Contract and manufacturer's requirements.
  - 10. All test areas deemed wet shall be repaired or replaced at the Contractor's expense. The Contractor, at its own expense may perform their own moisture tests to define smaller areas to propose repair or replacement of these smaller roof areas. The Project Representative may accept or reject these proposals at their discretion.
  - 11. If any portion of the roof is deemed wet the Project Representative may require a new Post-Construction Moisture Survey at their discretion.



- B. Wind Uplift Test:
  - 1. If any portion of the roof is deemed wet may the Project Representative may require an ASTM E907-96 (2004) wind uplift resistance test for any roof area at their discretion.
  - 2. Contractor Responsibilities: Provide access to roof, make core cuts or roof membrane preparations as required, and make all repairs at the Contractors' expense.
  - 3. King County's Responsibilities: Hire wind uplift testing firm at its own expense.
  - 4. All test areas that fail the Wind Uplift Test shall be repaired or replaced at the Contractor's expense.

### **3.15 ADJUSTING AND CLEANING**

- A. Repair of deficiencies: Installations of details noted as deficient during final inspection shall be repaired and corrected by applicator, and made ready for re-inspection, within five (5) days.
- B. Clean-up: Immediately upon job completion, roof membrane and flashing surfaces shall be cleaned of debris. Clean drains, gutters, and downspouts of debris.

**END OF SECTION**

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## SECTION 07550

### VEGETATED ROOF ASSEMBLY

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Provide equipment, materials, tools, and labor to install vegetated roofing assembly for the Georgetown Wet Weather Treatment Station buildings as indicated in the Drawings.
- B. The Vegetated Roof Assembly shall be a continuous coverage assembly meeting the requirements specified herein.
- C. System to include edge treatments, custom shaping of modules, and root barrier, as specified.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM F2396	Standard Guide for Construction of High Performance Sand-Based Rootzones for Athletic Fields
ASTM D6938	Standard Test Method for In Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)
ASTM F1647	Total Organic Matter, loss on ignition method (dry wt.)
FLL	Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau. (FLL) in English: The German Landscape Research, Development and Construction Society Guideline for the planning, execution and upkeep of green-roof sites.
ASTM E2399	Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems
ASTM D5957	Standard Guide for Flood Testing Horizontal Waterproofing Installations

- B. Qualifications:
  - 1. Installed three roofing systems similar in complexity and size. Three shall be within the Pacific Northwest.
  - 2. Installer shall have completed training by the green roof system manufacturer.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Informational Submittals:
  - 1. Maintenance protocol.
  - 2. Installation procedures and requirements.
  - 3. Certificate of completion of training issued by green roof system manufacturer.

4. Length of time required to install the green roof.
5. Address and contact information of professional horticulturist who will oversee planting and cultivation of modules.
6. Layout of modules, and square footage.
7. Warranty.
8. Three product design guides and supporting literature showing specifications and project photographs of completed jobs.

C. Product/Material Submittals:

1. Two plastic bags, each containing a 1 gallon (64oz.) sample of growing medium.
2. Moisture-Retention Mat: 12 by 12 inches.
3. Molded-Sheet Drainage Panels: 12 by 12 inches.
4. Protection Fabric.
5. Drainage Gravel.

#### **1.04 GROWING MEDIA TESTING**

A. General:

1. Laboratory Tests as described in this Section shall be conducted by an independent A2LA laboratory with the experience and capability to conduct the tests indicated.
2. Tests shall be completed on a minimum of three samples of the growing media mix.
3. Volume of samples provided shall be 150% of the amount determined to be necessary for compliance testing.

B. Provide test data reports for representative samples of the growing media used in the Work. Test reports shall include name of product, source of individual components and testing results for each batch of blended growing media and shall include the following tests:

1. Particle size distribution for Sand and Lightweight Sand components (ASTM C136).
2. Particle size distribution (ASTM D422) for Growing Media.
3. Specific Gravity of Soil Solids by Gas Pycnometer.
4. Maximum Media Density for Dead Load Analysis of Green Roof Systems.
5. Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones.
6. Organic Matter Content of the Rootzone Mixes.
7. Nutrient Analysis Reports as described for Growing Media.
8. Solvita maturity test for compost.

C. Growing Media Nutrient Analysis Reports: Provide test data reports for representative samples of the growing media used in the Work which shows results of analyzing representative samples and recommendations to correct soil nutrient or micronutrient deficiencies for the following properties.

1. pH.
2. Nutrients (ppm): Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg), Sulphur Dioxide (SO<sub>4</sub>), Sulfur, Calcium.

D. Additional growing media verification testing of the blended mix samples submitted may be performed by the County. Supply samples for testing of the individual components of the growing media materials used in the Work.

#### **1.05 WARRANTY**

- A. Manufacturer shall provide a Five (5) year guarantee that product will be free of material defects and against photodegradation.

- B. Special Warranty for Vegetated Roof Assembly: Installer agrees to repair or replace vegetated roof assembly and components that fail in materials or workmanship within specified warranty period. Failure includes, but is not limited to, ponding water or prolonged wetness of growing medium caused as a result of failure of the assembly to properly drain.

## PART 2 PRODUCTS

### 2.01 VEGETATED ROOF DRAINAGE COMPONENTS

- A. Moisture-Retention and Drainage Products:
1. Moisture-Retention Mat: Manufacturer's standard water-retaining fabric manufactured from [recycled] synthetic fibers.

### 2.02 VEGETATED ROOF ASSEMBLIES

- A. Continuous Vegetated Roof Assembly shall be a Continuous-coverage assembly consisting of manufacturer's standard vegetated roof assembly components for installation over membrane roofing.
1. Basis-of-Design Product: Subject to compliance with requirements, provide a continuous coverage vegetated roof assembly meeting the requirements specified by one of the following system manufactures:
    - a. American Hydrotech, Inc.
    - b. American Wick Drain Corporation Roof Garden System.
    - c. Prairie Technologies, Inc.; Prairie Green Roof System.
    - d. Approved Equal.
  2. Assembly Weight: Maximum 15 lb/sq. ft. (73 kg/sq.) including growing medium and plants and saturated with captured water, but not including weight of roofing system.
  3. Plantings: See Section 02970.

### 2.03 GROWING MEDIA

- A. Custom growing media mix produced from organic recycled material and inorganic by-products for use as light weight growing media.
- B. Capable of supporting vigorous growth of the specified vegetation.
- C. Pre-blended regionally and delivered to site for application in bulk.
- D. Components and properties as follows:

Property	Values*
<b>Grain Size Distribution</b>	
Clay Fraction	Less than 1%
Passing #200 sieve	1-3%
Passing #60 sieve	5-25%
Passing #18 sieve	20-50%
Passing 1/8-inch sieve	55-95%
Passing 3/8-inch sieve	90-100%
<b>Density</b>	
Application Density	0.6 – 1.1 g/cm <sup>3</sup> (38 lbs – 69 lbs/cf)
Saturated Density	0.9 – 1.4 g/cm <sup>3</sup> (56 lbs – 87 lbs/cf)
Dry Density	0.5 – 1.0 g/cm <sup>3</sup> (31 lbs – 62 lbs/cf)
<b>Water &amp; Air Management (% volume)</b>	
Saturated Water Capacity	Greater than 30%
Saturated Air Content	Greater than 10%
Saturated Hydraulic Conductivity	Greater than 0.6 mm/min (1.4 in/hr)

Property	Values*
<b>pH, Lime and Salt Content</b>	
pH (saturated paste)	6.0 – 7.5
Carbonate Content	Less than 25 g/l
Salts Content (water extract)	Less than 2.5 g/l
<b>Organics</b>	
OM Content	3 – 6 mass %
C/N Ratio	Less than 20
Nutrients** (plant available)	In lb/1000 ft <sup>3</sup>
Nitrogen (NO <sub>3</sub> )	3 - 15
Phosphorus	1 - 7
Calcium	19 - 65
Magnesium	3 - 15
CEC Capacity	Greater than 5 cmol/kg

\* Values shall be adjusted due to availability of local materials or special project conditions related to plant selection and/or environmental conditions.

\*\* Nutrients shall be adjusted with appropriate slow-release fertilizer with micronutrient additions if below lower target range.

## 2.04 ROOT BARRIER

- A. Provided by Membrane Manufacturer. Confirm compatibility of root barrier and waterproofing membrane with manufacturer.
- B. Do not use duct tape or adhesive for seaming that is not approved by the membrane manufacturer.

## 2.05 ACCESSORIES

- A. Irrigation System: See Section 02810.
- B. Membrane integrity test system: See Section 07555.
- C. Gravel ballast: See Section 02900.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine each area to receive vegetated roof assembly for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify that roof insulation over membrane roofing is in place, secure, and flush along seams.
  - 2. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by vegetated roof assembly.
- B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing and protecting membrane roofing but before placing overlaying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
- C. Flood to an average depth of 2-1/2 inches (65 mm,) with a minimum depth of 1 inch (25 mm) and a maximum depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of sheet flashings.
  - 1. Flood each area for 24 hours.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

- E. Inspect growing medium. If growing medium is contaminated by foreign or deleterious material or liquid, remove growing medium and contamination and replace with new growing medium.

### **3.02 INSTALLATION, GENERAL**

- A. Install vegetated roof assembly according to manufacturer's written instructions.

### **3.03 PREPARATION OF ROOF SURFACE**

- A. All surfaces shall be smooth, free of debris, soil, and grit prior to placing the modules. Materials shall be tested, water tight and free draining prior to module placement.
- B. Root barrier, of 1-1.5 mm (40-60 mil) thickness with overlapped and effectively bonded seams to ward against root penetration and to keep waterproofing layer safe and clean from soil during installation.
  - 1. Use manufacturer's approved seaming method.
  - 2. Never use moisture holding fabric, such as needle-punched polyethylene or felt, under the green roof system.
- C. All surfaces to be maintained clean and free of debris, soil, and grit during installation process via use of broom. Never walk upon such materials as they may damage membranes.

### **3.04 INSTALLATION SEASON**

- A. Coordinate installation of vegetated mats with Section 02970.

### **3.05 DELIVERY, STORAGE, HANDLING, PROTECTION**

- A. During installation, protect the roof deck and membranes with appropriate material such as plywood sheeting. Never scrape or puncture slip sheet or membranes. Keep roof surfaces free of soil, grit, or debris with broom.

### **3.06 SAFEGUARDING SYSTEM INTEGRITY**

- A. Before working on roof, Installers and Laborers are to be:
  - 1. Properly instructed in safety procedures and provided with green roof manufacturer's Installation Standardized Procedures.
  - 2. Instructed to keep work surfaces clean and debris free.
  - 3. To report immediately any damage to membranes, protective sheeting, or drain elements to supervisor, and to make appropriate repairs before proceeding.
  - 4. Instructed in proper methods of green roof installation by manufacturer trained and approved representative of installation company.

### **3.07 GROWING MEDIA**

- A. Spread a minimum of 4 inches growing media over the vegetated roof system.
- B. Level growing media with large rake.
- C. Suspend spreading and grading operations during periods of excessive moisture until the moisture content in growing medium reaches acceptable levels to attain the required results.
- D. Uniformly moisten an excessively dry growing medium that is too dusty or not workable.
- E. Thoroughly wet the media before overlaying with vegetated mats.

### **3.08 PLANTING**

- A. See Section 02970.

### **3.09 SOIL-RETAINER INSTALLATION**

- A. Install soil retainer where indicated according to manufacturer's written instructions.

### **3.10 CLEAN UP**

- A. Throughout installation, keep all work surfaces clean and free of grit, dirt, or debris. Use broom not blower, do not sweep soil under modules or slip sheet. Do not place modules upon soil, dirt, stones or grit. Following installation, remove all excess materials.

**END OF SECTION**



## **SECTION 07555**

### **MEMBRANE INTEGRITY TEST SYSTEM**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes: Waterproofing membrane integrity test system, including the following:
  - 1. Leak detection conductor cable and accessories.
  - 2. Leak detection testing of installed membrane.

##### **1.02 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Manufacturer of membrane integrity test systems with minimum five-year record of satisfactory manufacturing and support of installed systems comparable to system required as Work of this Section.
- B. Installing and Testing Firm Qualifications: Approved or certified by membrane integrity test manufacturer, with minimum three-year record of satisfactory experience.

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: For each type of product required for a complete membrane leak detection system.
- C. Shop drawings: Showing the following: Diagram of proposed system showing complete monitored area, rooftop structures and equipment, and roof penetrations for building utilities and services. Show location of membrane integrity test system conductor cable.
- D. Qualifications: For manufacturer, and installing and testing firm.
- E. Field Quality Control Reports: Digital drawings, digital photographic documentation, and written report detailing location and nature of membrane breaches, defects found, and verification of corrective actions taken.
- F. Record drawings: Digital drawings, photographic documentation, and written report detailing installed location of components of membrane leak detection system and connection boxes.

##### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Integrate layout of membrane integrity test system with rooftop structures and equipment and roof penetrations for building utilities and services.
  - 2. Coordinate membrane integrity test system with work of other Sections.
- B. Pre-installation Meetings: Conduct pre-installation meeting in coordination with the waterproofing pre-installation conference to verify project requirements, manufacturer's installation instructions, and coordination with installation requirements for membrane and roof ballast.

## **1.05 CORRECTION PERIOD SERVICES**

- A. Perform field quality control testing at end of one-year period for correction of Work.
  - 1. Repair defects in membrane and retest to demonstrate membrane integrity.
  - 2. Submit test and retest reports.

## **PART 2 PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. International Leak Detection (ILD).
- B. Approved Equal.

### **2.02 SYSTEM DESCRIPTION**

- A. Membrane Integrity Test System: Conductor cable, placed on top of membrane, delivering direct current tension to membrane surface, enabling inspection and isolation of points of moisture infiltration through membrane to conductive substrate under membrane.

### **2.03 MATERIALS**

- A. Conductor Cable: Nine strands of 0.06 inch (1.5 mm) diameter highly-conductive stainless steel wire interwoven with braided polyethylene strands, placed on weather side of membrane:
  - 1. International Leak Detection, Vector-9 Conductor Wire.
  - 2. Approved Equal.
- B. Contact Box: Weatherproof, corrosion-resistant electrical enclosure with permanent terminal connections for connecting diagnostic and testing equipment, NEMA 4X with the following characteristics:
  - 1. Permanent connections for attachment of diagnostic and testing equipment without opening contact box.
  - 2. Weatherproof cover to seal terminals when leak detection system is not in use.
  - 3. Hardware, brackets, and fittings required to permanently mount contact box to building structure.
  - 4. Acceptable Manufacturers:
    - a. International Leak Detection, EFVM Connection Box.
    - b. Approved Equal.

### **2.04 ACCESSORIES**

- A. Provide corrosion-resistant fasteners and hardware, electrical terminations, sealants, and other items required to provide complete installation.
- B. Lap Joint Tape: Provide self-adhesive tape, minimum 2 inch (50 mm) wide.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Examination: Verify that substrate complies with the manufacturer's waterproofing system and integrity test manufacturer's requirements. Proceed with installation once substrate complies with requirements.

- B. Conductor Wire: Install conductor wire on top of membrane, but below protection layer at spacing and layout indicated on approved shop drawings.
  - 1. Secure conductor wire using method recommended by waterproofing system manufacturer.
- C. Installation Testing: Verify continuity and functioning of conductor wire upon completion of installation.

### **3.02 FIELD QUALITY CONTROL**

- A. After completion of waterproofing system installation, engage Installation and Testing Firm to perform waterproofing membrane integrity testing. Perform testing in accordance with integrity test system manufacturer's recommendations.
  - 1. Perform testing following adequate precipitation or wet membrane and membrane overburden adequately to enable accurate testing.
  - 2. Identify locations of membrane leaks; record locations and document with photographs. Submit test reports to Project Representative.
  - 3. Confirm completed repair of identified leaks and retest to verify water tightness of membrane.
- B. Initial Membrane Test: Perform initial leak detection test upon completion of membrane and leak detection system installation and prior to installation of above-membrane components.
- C. Assembly Test: Repeat leak detection test following installation of above-membrane components.
- D. Final Testing: Repeat leak detection test if roof assembly is exposed to traffic or construction operations prior to Substantial Completion.

### **3.03 PROTECTION**

- A. Protect tested membrane according to manufacturer's requirements.

**END OF SECTION**

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**SECTION 07610**  
**SHEET METAL ROOFING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies:
1. Standing seam metal roofing, including sheet metal flashing, gutters and downspouts, access hatch curbs, and accessories directly related to the metal roofing system.
  2. Underlayment membranes.
  3. Gypsum sheathing at metal roof assembly.
  4. Rigid insulation at metal roof assembly.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A653	Steel Sheet, Zinc Coated, (Galvanized), or Zinc - Iron Alloy Coated by the Hot Dip Process.
ASTM A792	Steel Sheet, 55% Aluminum- Zinc Alloy- Coated by the Hot Dip Process
ASTM C1177	Standard Specification for Glass Mat Gypsum Substrate.
ASTM C1289	Standard Specification for Forced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
ASTM D659	Method for Evaluating Degree of Chalking of Exterior Paints.
ASTM D2244	Method for Instrumental Evaluation of Color Differences of Opaque Materials.
ASTM E1592	Standard Test Method for Structural Performance of Sheet metal Roof and Siding Systems
ASTM E1680	Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
ASTM E1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
ASTM E1980	Standard Practice for Calculating Solar Reflectance.
SMACNA	Sheet Metal and Air Conditioning Contractors National Association. Architectural Sheet Metal Manual.

- B. Installer: Company specializing in sheet metal roofing installation with minimum three years documented experience in installations of type and scope similar to that of this project.
- C. Pre-Installation Meeting: In accordance with Section 01200.
1. Administer a pre-roofing meeting prior to starting the Work of this Section.
  2. Require in attendance the following parties:
    - a. Owner.
    - b. Project Representative.
    - c. Roofing Installer.
    - d. Sheet Metal Installer.
    - e. Roofing manufacturer's representative.

3. Agenda: Review field conditions, procedures, details, anchorage methods - including details of fixed and sliding connections, provisions for thermal movement, and sequence of construction. Discuss and determine responsibility for protection of the work during and after construction, and subsequent maintenance of the roofing system.
- D. Wind-Uplift Tested Assemblies: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated; Class 60.
- E. Panel structural properties shall be determined in accordance with latest edition of American Iron and Steel Institute's "Cold Formed Steel Design Manual," using "effective width" concepts.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Submit for materials and proprietary systems proposed for the Work. Include published literature on UL wind uplift classification for roofing system, if available.
- C. Shop drawings:
  1. Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, penetrations, and installation details.
  2. Include manufacturer's installation instructions for manufactured items incorporated in Work.
- D. Samples: Submit a minimum of 3 samples of roofing material, with finish and texture proposed for the Work.
- E. Submit shop drawings and details, product data sheets, fastening specifications and a RoofNav Contractor Package for FMGlobal review prior to ordering materials.

### **1.04 SYSTEM DESCRIPTION**

- A. Resistance to Water Infiltration:
  1. System shall be designed and installed to preclude entrance of water to the building interior.
  2. System shall have been laboratory tested to show no leakage through panel joints when tested in accordance with ASTM E 1646 at static test pressure differential of 15.00 psf.
- B. Air Infiltration: System shall have been laboratory tested to show air leakage through the assembly of not more than 0.022 cfm/lineal ft. of panel seam at 12 psf when tested in accordance with ASTM E 1680.
- C. Structural Performance:
  1. Provide metal roof panel assemblies capable of withstanding the effects of dead loads and live loads indicated in the Structural Drawings. Performance shall be based on testing according to ASTM E1592.
  2. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 of the span.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in accordance with this Section.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.
- C. Protect stored materials from heat and direct sunlight.

- D. Prevent contact with materials during storage which may cause discoloration or staining.

## **1.06 ENVIRONMENTAL REQUIREMENTS**

- A. Do not apply waterproofing during inclement weather or when air temperature is below 40 degrees F.

## **PART 2 PRODUCTS**

### **2.01 SHEET METAL ROOFING SYSTEM**

- A. Roofing System: .System shall consist of cleat retained snap seamed standing seam flat metal roofing pans; 18 inch nominal width; nominal 2 inch.seam height.
- B. Approved Systems:
  - 1. CB-2000 by Custom Bilt Metals.
  - 2. "238T" by McElroy Metal.
  - 3. "Magna-Loc" by Metal Sales Manufacturing Corp.
  - 4. Approved Equal.
- C. Use assemblies listed in the online database RoofNav application at [www.roofnav.com](http://www.roofnav.com) with an FM Global windstorm classification of 1A-60.

### **2.02 SHEET MATERIALS**

- A. Prefinished Steel Sheet:
  - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: 22 gage core steel with ASTM A 792, Class AZ-55 coating, Grade 40; structural quality.
  - 2. Factory Finish:
    - a. Minimum 70 percent resin Kynar 500 or Hylar 5000 fluoropolymer system complying with AAMA 2605; color to match sheet metal siding specified in Section 07410.
    - b. Minimum SRI of 78 when tested in accordance with ASTM E1980.
  - 3. Protective Backing Paint: Manufacturer's standard painted finish.

### **2.03 ACCESSORY MATERIALS**

- A. Fasteners:
  - 1. Exposed Applications: Galvanized steel with soft neoprene washers, factory prefinished to match roofing color.
  - 2. Nailers, Cleats, and Other Concealed Applications: Hot dip galvanized; sizes as recommended by the roofing materials manufacturer.
- B. Downspouts:
  - 1. ANSI Schedule 40 pipe as indicated in the Drawings.
  - 2. Finish as specified in Section 09900.
- C. Sealant: As recommended by the manufacturer of the roofing materials.
- D. Insulation: Polyisocyanurate insulation; fiberglass or felt facers; HC blown. Calculate R values based on LTTR value when tested in accordance with the current edition of ASTM C1289; maximum 5.7R per inch.
- E. Gypsum Roof Sheathing: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, "Dens-Deck Prime" by Georgia-Pacific Corporation, or Approved Equal; 5/8 inch thickness.

- F. Waterproof Membrane Underlayment:
  - 1. "Ultra" by WR Grace Construction Products.
  - 2. "Polystick MU Basik," by Polyglass USA Inc.
  - 3. Approved Equal.
- G. Cold Fluid Applied Waterproofing at Concrete Parapet:
  - 1. "CM100" by The Henry Company; reinforced high-build system.
  - 2. Accessory Materials:
    - a. Reinforcing fabric: "Polyfab" fabric reinforcing by the Henry Company.
    - b. Flashing membrane: "990-25" membrane by the Henry Company.
- H. Parapet Cladding: As specified in Section 07410.
- I. Touch-up Paint: Manufacturer's special color-matched material, formulated for retouching fluoropolymer finishes.

## **2.04 FABRICATION**

- A. Fabricate cleats and starter strips from minimum 20-gage galvanized steel sheet material, unless recommended otherwise by the metal roofing manufacturer.
- B. Apply strippable film for protection during shipping, fabrication and installation.
- C. Cut and form in accordance with reviewed shop drawings, using recognized sheet metal practices. Perform cutting with clean, sharp properly aligned shearing tools; do not saw or file edges of sheets.
- D. Form pieces in longest practical lengths.
- E. Fabricate flashing and sheet metal, including gutters, in accordance with the requirements specified in Section 07620.
- F. Form watertight curb to receive roof access hatch.

## **2.05 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Prior to starting work, carefully examine installed work of other trades and verify that such Work is complete to the point where Work of this Section may properly commence, Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.
- C. Verify that substrate is clean, dry, and smooth, free of depressions, waves, and projections. Verify that items required to penetrate roof are solidly set.



### **3.02 ROOF INSULATION INSTALLATION**

- A. Screw fasten Z furring to metal deck as necessary to receive rigid insulation and roofing hold down clips.
- B. Install roof insulation over metal deck and tightly within sub frame members. Secure with screw fasteners and plastic plates as necessary to prevent blow off or damage prior to installation of the rest of the metal roof assembly.
- C. Edges shall be tightly butted without deformation.
- D. Protect insulation from weather exposure at all times until roofing is installed.
- E. Provide insulation thickness for R value indicated in the Drawings.

### **3.03 SHEATHING INSTALLATION**

- A. Install sheathing over insulation with joints tightly butted.
- B. Screw fasten a maximum of 12 inches on center along framing members.
- C. Provide a uniform solid surface as necessary to receive underlayment.

### **3.04 ROOFING INSTALLATION**

- A. Waterproof Membrane:
  - 1. Apply waterproof membrane in accordance with the manufacturer's recommendations.
  - 2. Lap to weather.
  - 3. Install a minimum of 48 inches out from each valley.
- B. Perform metal roofing work in accordance with roofing manufacturer's instructions.
- C. Install starter strips, edge strips, flashing receivers, valley liners, and cleats before starting installation of roofing sheets; nail cleats at 12 inches on center, using two nails per cleat, or, where cleats are continuous, space nails two per foot.
- D. Install each roofing pan as a single continuous piece. Install systems to allow for expansion of the panels.
- E. Install ridge caps, valley pans, and other flashing and sheet metal as single continuous lengths to the greatest extent possible.
- F. Conceal fasteners wherever possible.
- G. Seal all joints, except for factory sealed standing seams; seal intersections of standing seams.
- H. Install cap flashings into receivers and secure with color matched neoprene gasketed screws at maximum 24 inch o.c.
- I. Coordinate and schedule work such that the membrane roofing is complete prior to installation of the metal roofing system.
- J. Touch-up scratched and damaged surfaces with matching material. Replace components which cannot be touched up or otherwise repaired with new conforming materials.

- K. Install additional fastening at the perimeters and corners per FMGlobal Data Sheet 1-29, Roof Deck Securement for Above-Deck Roof Components and the roof system's Approval listing.

**END OF SECTION**

## SECTION 07620

### SHEET METAL FLASHING AND TRIM

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies flashing and sheet metal not specifically described in other Sections but required to prevent penetration of water through the exterior shell of the building.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A123	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM D1784	Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

- B. Perform the Work in accordance with SMACNA: Architectural Sheet Metal Manual, as a minimum standard, and to normal good practice in the area except where in conflict with the Contract Documents, which shall govern.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data.

##### 1.04 STORAGE AND HANDLING

- A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

#### PART 2 PRODUCTS

##### 2.01 SHEET METAL

- A. Aluminum Sheet:
  - 1. Unless otherwise indicated, mill standard 3008 alloy aluminum sheet.
  - 2. Unless otherwise indicated, 0.040 inch.
  - 3. Clear Anodized Finish:
    - a. Conform to AAMA AA-M31C22A41.
    - b. Architectural Class I, etched, medium matte, clear anodic coating, 0.7 mil thickness.
- B. Prefinished Steel Sheet:
  - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage core steel with ASTM A 792, Class AZ-55 coating, Grade 40; structural quality.

2. Factory Finish:
  - a. Minimum 70 percent resin Kynar 500 or Hylar 5000 fluoropolymer system complying with AAMA 2605; standard color as selected by the Project Representative.
  - b. Minimum SRI of 78 when tested in accordance with ASTM E1980.
3. Protective Backing Paint: Manufacturer's standard painted finish.

## **2.02 ACCESSORIES**

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers, or Type 304 stainless steel, with soft neoprene washers.
- B. Underlayment: No. 15 asphalt saturated roofing felt.
- C. Sealant: Specified in Section 07900.
- D. Plastic Cement: Asbestos-free asphaltic base cement.

## **2.03 REGLETS**

- A. Cast in Concrete:
  1. ASTM D1784, Type II, extruded PVC.
  2. Minimum 0.075-inch thick.
  3. Acceptable Manufacturer:
    - a. Fry Reglet, "Fry Springlok Type CO".
    - b. C&J Metals, Masonry Reglet Set.
    - c. Approved Equal.
- B. Surface Mounted:
  1. 2-piece, snap-in type system.
  2. Aluminum, .025 coated or anodized.
  3. Corner shall be factory made, mitered and sealed.
  4. Acceptable manufactures:
    - a. Fry Reglet, Fry Springlok Type SM.
    - b. C&J Metals, Tilt-Up/Surface Mount Reglet Set.
    - c. Approved Equal.

## **2.04 FABRICATION**

- A. Form components true to shape, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.
- B. Fabricate cleats and starter strips of same material as flashing, minimum 2 inches wide, interlockable with flashing.
- C. Hem exposed edges on underside 1/2-inch. Miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4-inch and hemmed to form drip edge.
- D. Form material with standing seam.
- E. Fabricate corners in one piece, 8-inch legs minimum. Seam for rigidity and seal with sealant.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces to be covered are smooth, clean, and free from holes.
- B. Drive flush all projecting nails.
- C. Do not proceed with installation until discrepancies have been resolved.

### **3.02 INSTALLATION**

- A. Separate flashings from dissimilar materials by a heavy bitumastic coating on the flashing.
- B. Expansion:
  - 1. Form, fabricate, and install sheet metal to adequately provide for expansion and contraction in the finished Work.
  - 2. Unless otherwise indicated, provide suitable watertight expansion joints for all runs of more than 40 feet.
- C. Reglets:
  - 1. Install level and true in forms a minimum of 7 inches above cant strip.
  - 2. Tape cut ends before installation.
  - 3. After roofing is applied install flashing by snapping into reglet without screws.
  - 4. Lap all joints and miter corners.
- D. Fastening:
  - 1. Whenever possible, secure metal by means of continuous clips or cleats without nailing through the metal.
  - 2. In general, space nails, rivets, and screws not more than 8 inches apart. Where exposed to the weather, use neoprene washers.
  - 3. For nailing into wood, use 11-gage barbed roofing nails long enough to penetrate 3/4-inch.
  - 4. For fastening into concrete, use drilled plugholes and plugs. Penetrate 1 inch.

**END OF SECTION**

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## **SECTION 07720**

### **ROOF HATCHES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section specifies roof hatches.

##### **1.02 QUALITY ASSURANCE (NOT USED)**

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Shop drawings of specified material.
- C. Manufacturer's product data, including installation instructions and recommendations for storage.

#### **PART 2 PRODUCTS**

##### **2.01 ACCEPTABLE MANUFACTURER**

- A. Bilco Co.
- B. Milcor.
- C. Approved Equal.

##### **2.02 BASIS OF DESIGN PRODUCT**

- A. Bilco Type E Rood Hatch, 36 inches by 36 inches.

##### **2.03 COVER**

- A. 0.090-inch aluminum with 3-inch beaded flange.
- B. 1-inch thick glass fiber insulation fully covered with 0.036-inch aluminum interior liner.

##### **2.04 CURB**

- A. 12-inch high, 0.090-inch aluminum with fully welded corners and an integral cap flashing of 0.090-inch aluminum.
- B. The insulation on the exterior of the curb shall be 1-inch thick rigid fiberboard.

##### **2.05 HATCH**

- A. Fully assembled with:
  - 1. Heavy pintle hinges.
  - 2. Compression spring operators enclosed in telescopic tubes.
  - 3. Positive snap latch with turn handles and padlock hasps inside and outside.
  - 4. Neoprene draft seal.

- B. Cover shall be equipped with an automatic hold open arm with vinyl grip handle to permit one-hand release.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. In accordance with manufacturer's written instructions.
- B. Plumb roof hatch drain to allow drainage of roof hatch.
- C. See Section 15050 for material requirements.

**END OF SECTION**



## **SECTION 07800**

### **UNIT SKYLIGHTS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section specifies furnishing and installing fall protection skylights and related accessories.

##### **1.02 QUALITY ASSURANCE (NOT USED)**

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Manufacturer's product data including test results demonstrating Fall Protection performance.
- C. Shop drawings showing skylight cross-sections and the installation details.
- D. Engineering calculations.
- E. Sample.

#### **PART 2 PRODUCTS**

##### **2.01 FIXED UNIT SKYLIGHTS**

- A. Factory assembled units consisting of G.E. Lexan Thermoclear sheet heat formed double dome, classified CC1 per ASTM D635 in clear anodized retaining frame and extruded curb frame with integral condensation and weepage gutter.
- B. Acceptable Products:
  - 1. "Coollite" unit skylight by Kingspan Light + Air.
  - 2. Approved Equal.
- C. Glazing:
  - 1. Outer layer: Coollite Acrylic.
  - 2. Inner layer: Clear Prismatic.

##### **2.02 REMOVEABLE UNIT SKYLIGHTS**

- A. Factory assembled units consisting of Manufacturer's cellular polycarbonate panels, classified CC1 per ASTM D635 in clear anodized retaining frame and extruded curb frame with integral lifting lugs, and condensation and weepage gutter.
- B. Acceptable Products:
  - 1. "Toplite" unit skylights by CPI Daylighting.
  - 2. Approved Equal.
- C. Glazing: 5/8 inch Pentaglas Polycarbonate.

## **2.03 METAL FRAMED SKYLIGHTS**

- A. Site assembled unit consisting of Manufacturer's cellular polycarbonate panels, classified CC1 per ASTM D635 in clear anodized retaining frame and extruded curb frame with integral condensation and weepage gutter.
- B. Acceptable Products:
  - 1. "Quadwall" metal framed skylights by CPI Daylighting.
  - 2. Approved Equal.
- C. Glazing
  - 1. Exterior: 10mm Clear Polycarbonate.
  - 2. Interior: 8mm White Polycarbonate.

## **2.04 FLASHING**

- A. Specified in Section 07620.
- B. Use skylight curb tape in all skylight installations.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Installation shall be in accordance with manufacturer's instructions for the conditions indicated in the Drawings.
- B. Make installation weather-tight.

### **3.02 TESTING**

- A. Upon completion of the work, perform a leakage test over all surfaces of each skylight to the satisfaction of the Project Representative.
- B. Spray skylights with a garden type hose nozzle for a minimum period of 10 minutes.
- C. Trace moisture found on interior surfaces to the point of entry and repair the faulty work. Retest.

**END OF SECTION**

## SECTION 07810

### APPLIED FIREPROOFING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
1. Sprayed fireproofing on structural steel and deck members.
  2. Schedule of ratings.
  3. ENVISION documentation.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E84	Test for Surface Burning Characteristics of Building Materials.
ASTM E119	Fire Test of Building Construction and Materials.
ASTM E736	Cohesion/Adhesion of Sprayed Fire Resistive Materials Applied to Structural Members.
ASTM E759	Effect of Deflection of Sprayed Fire Resistive Materials Applied to Structural Members.
ASTM E760	Impact on Bonding of Sprayed Fire Resistive Materials Applied to Structural Members.
ASTM E761	Compressive Strength of Sprayed Fire Resistive Materials Applied to Structural Members.
ASTM E859	Air Erosion of Sprayed Fire Resistive Materials Applied to Structural Members.
ASTM G21	Standard Test Method to evaluate resistance of synthetic polymer Materials to Fungi.
ICC	International Code Council
OSHA	Occupational and Health Act
UL	Underwriters Laboratories, Inc. Fire Resistive Directory (latest edition).

- B. Applicator Qualifications: Approved by the manufacturer of the fireproofing.
- C. Regulatory Requirements:
1. Comply with requirements of the jurisdictional code authority.
  2. Submit Test Reports, Evaluation Reports, or other data as required by the jurisdictional code authority to obtain approval for the fire ratings scheduled.
- D. Fireproofing installation is subject to Owner paid testing and inspection as specified in Section 01410.
- E. Use of sprayed fireproofing materials shall not result in asbestos exposures to workers or building occupants exceeding the US OSHA Action Level: 29 CFR 1926.55(c), at any time during or subsequent to application.

- F. Mock-up:
  - 1. Provide mock-ups in accordance with this Section.
  - 2. Apply a minimum 100 square feet of applied fireproofing in a location as reviewed by the Project Representative.
  - 3. Approved mock-ups may be used in the Work.
- G. Pre-Installation Conference: In accordance with Section 01300.
  - 1. Schedule prior to commencement of fireproofing installation.
  - 2. Require in attendance:
    - a. General Contractor.
    - b. Project Representative.
    - c. Fireproofing materials manufacturer's representative.
    - d. Fireproofing installer.
    - e. Other parties directly affected by the Work.
  - 3. Agenda: Review procedures, schedule, and sequence of installation, including mock-up review, criteria for acceptance, thicknesses of materials, substrate requirements, field quality control, sequencing with roofing and other overhead Work, cleanup, responsibility for protection of the work during and after construction, and patching.
- H. Each fireproofing bag shall be UL labeled to designate formulation compliance.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Submit complete product data for sprayed fireproofing systems. Include description of materials, installation recommendations, evidence of conformance to performance requirements, and procedures required for patching.
- C. Quality Control Submittals:
  - 1. Test Reports: ICC Evaluation Reports or UL Test Reports for each condition, in accordance with ASTM E119.
- D. ENVSION Submittals:
  - 1. Make ENVSION submittals in accordance with Section 01350.

### **1.04 SYSTEM DESCRIPTION**

- A. Medium Density Fireproofing Performance:
  - 1. Dry Density: Minimum 22 pcf.
  - 2. Fire Hazard: 25 or less flame spread, 50 or less fuel contributed, and 50 or less smoke developed, when tested in accordance with ASTM E84.
  - 3. Compressive Strength: 80PSI when tested in accordance with E761.
  - 4. Impact Strength: No cracking or delamination when tested in accordance with ASTM E760.
  - 5. Air Erosion: 0.00 g/sf of weight loss when tested in accordance with ASTM E859, under an 800 fpm air stream for a minimum of 6 hours.
  - 6. Bond Strength: Minimum of 1000 psf when tested in accordance with ASTM E736.
  - 7. Resistance to Mold: Minimum 28 days in accordance with ASTM G21.
- B. High Density Fireproofing Performance:
  - 1. Dry Density: Minimum 35 pcf.
  - 2. Fire Hazard: 25 or less flame spread, 50 or less fuel contributed, and 50 or less smoke developed, when tested in accordance with ASTM E84.
  - 3. Bending: No cracking or delamination when subject to deflection of not less than 1/120 the span, when tested in accordance with ASTM E759.
  - 4. Compressive Strength: 50,000 psf when tested in accordance with E761.

5. Impact Strength: No cracking or delamination when tested in accordance with ASTM E760.
  6. Bond Strength: Minimum of 7,000 psf when tested in accordance with ASTM E736 (modified as necessary to accommodate the specified load requirements).
  7. Resistance to Mold: Minimum 28 days in accordance with ASTM G21.
- C. Recycled Content: Aggregates in fireproofing material (excluding cementitious binder) shall comprise a total of 100 percent pre- and post-consumer recycled materials.

## **1.05 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain minimum air and substrate temperature of 40 degrees F for 24 hours before, and 24 hours after application of fireproofing material.
- B. Provide natural or mechanical ventilation during and after application as required to properly dry the fireproofing, and maintain a non-toxic unpolluted working environment.

## **PART 2 PRODUCTS**

### **2.01 FIREPROOFING SYSTEMS**

- A. Medium Density Fireproofing:
  1. "Zonolite Z-106/G." by Grace Construction Products.
  2. "Cafco 400", Isolatek International (Stanhope NJ).
  3. Approved Equal.
- B. High Density Fireproofing:
  1. "Zonolite Z146." by Grace Construction Products.
  2. "Fendolite M-II", by Isolatek International.
  3. Approved Equal.

### **2.02 ACCESSORIES**

- A. Cementitious Hardcoat: Manufacturer's recommended sanded gypsum or portland cement based plaster as approved by the jurisdictional code authorities for protection of the system.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Provide protective coverings to prevent overspray on finished surfaces, and on surfaces to receive additional finish materials or treatment. Close off and seal ductwork in areas where fireproofing is being applied.
- B. Clean surfaces to be fireproofed of materials which would impair bond.

- C. Confirm compatibility of surfaces to receive fireproofing material.
- D. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- E. Coordinate fireproofing application with the work of other Sections to minimize subsequent damage to fireproofing.
  - 1. Apply sprayed fireproofing to the underside of the roof deck assemblies only after roofing application is complete and roof traffic has ceased.
  - 2. Apply fireproofing to floor decks only after concrete Work is complete.

### **3.03 INSTALLATION**

- A. Apply sprayed fireproofing in accordance with the manufacturer's printed installation instructions and in accordance with the approved fire rated assemblies to obtain the hourly fire ratings scheduled.
- B. Provide high density fireproofing at exposed structural steel members less than 8 feet from any floor or landing. When approved by the jurisdictional code authorities, low density or medium density fireproofing material with a protective high density cementitious hardcoat may be used in lieu of the high density fireproofing at these locations.
- C. For mineral fiber systems only, apply spray sealer to surfaces of fireproofing exposed in elevator equipment rooms, return air plenums, and other areas exposed to air movement greater than 5 fps. Apply at the rate of 200 square feet per gallon, unless otherwise recommended by the manufacturer.

### **3.04 CLEANUP**

- A. Patching:
  - 1. Patch damaged areas to maintain the fire rating of the assembly.
  - 2. Patch using UL-approved materials and procedures.
  - 3. Patching shall be performed by applicator applying fireproofing only, and at no additional cost.
- B. After completion of fireproofing work, remove equipment and clean exposed wall, ceiling and floor areas of deposits of sprayed fireproofing materials.

### **3.05 SCHEDULE**

- A. Medium density fireproofing: All locations, unless noted otherwise.
- B. High density fireproofing: All areas susceptible to high moisture, and where required by jurisdictional authorities.

### **3.06 UNRESTRAINED HOURLY RATING**

- A. Sprayed fireproofing beneath floor assembly, together with the assembly above: 1 hour rating.

## **END OF SECTION**

## SECTION 07840

### PENETRATION FIRESTOPPING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies firestopping systems for sealing penetrations through fire-rated construction.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E119	Method for Fire Tests of Building Construction and Materials.
ASTM E814	Methods for Fire Tests of Through- Penetration Fire Stops.
UL 263	Underwriters Laboratories: Fire Tests of Building Construction and Materials
UL 1479	Underwriters Laboratories: Fill, Void or Cavity Materials and Through-Penetration Firestop Systems.

- B. Code Verification: Prior to installation of fire stopping systems obtain approval from the jurisdictional code authorities for the fire stopping systems and applications proposed.
- C. Firestopping:
1. Tested in accordance with ASTM E119, ASTM E814, UL 263, or UL 1479 to meet the hourly fire ratings of the construction being sealed.
  2. Provide F rated assemblies, except where T rated assemblies are required by the code authority.
- D. Firestopping systems shall be UL listed assemblies.
- E. Voc limits for Sealants and Primers: Field applied materials shall conform to the requirements of the Southern California South Coast Air Quality Management District (SCAQMD) Rule 1168.
1. Sealants: Maximum VOC content of 250 grams/liter.
  2. Primers: Maximum VOC content of 250 grams/liter for non-porous surfaces; 750 grams/liter for other surfaces.
- F. Subcontractor Qualifications: Firestopping Work shall be performed by a single firestopping subcontractor, specializing in the installation of firestopping systems.
- G. The firestopping systems shall be subject to Owner paid inspection. Inspection will be performed in accordance with the requirements of ASTM E2393.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data.

##### 1.04 SYSTEM DESCRIPTION

- A. Each firestopping system shall be selected to maintain fire rating of the assembly in which it is used.

- B. Firestopping systems shall be resilient as necessary to accommodate differential movement between assemblies.
- C. Where firestopping is used to seal penetrations through floors with waterproof membranes, system shall be selected for compatibility with membrane material.

## **1.05 ENVIRONMENTAL CONDITIONS**

- A. Environmental Requirements: Comply with manufacturer's recommendations.
- B. Maintain maximum ventilation to remove volatile emissions produced during the installation process.

## **PART 2 PRODUCTS**

### **2.01 FIRESTOPPING SYSTEMS**

- A. Acceptable manufacturers:
  - 1. Metacaulk.
  - 2. Tremco Inc.
  - 3. Hilti USA.
  - 4. Grace Construction Products.
  - 5. RectorSeal.
  - 6. Specified Technologies, Inc.
  - 7. 3M.
  - 8. Approved Equal.
- B. Electrical Box Intumescent Pads:
  - 1. Preformed intumescent pads for molding around the backside of electrical outlet boxes and sealing to perimeter construction.
  - 2. Basis of Design Products:
    - a. Biostop Fire Rated Intumescent Putty pads by RectoSeal.BioFireshield.
    - b. CP617 Fire Stop Putty Pads by Hilti.
    - c. Approved Equal.
- C. Self Contained Sealing Systems: EZ Path by Specified Technologies, Inc, or Approved Equal. System shall permit cables to be removed and installed without adjustment, removal, or reinstallation of firestopping materials; size each assembly to accommodate 25% more cable than installed in the Project.
- D. Systems with sodium silicate shall not be used.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.



### **3.02 INSTALLATION OF FIRESTOPPING**

- A. Provide firestopping at mechanical, electrical, and plumbing penetrations through fire rated floors, walls, and ceilings, and other locations as indicated in the Drawings.
- B. Use self contained sealing systems at all data, video, and communications cable locations.
- C. Install firestopping in accordance with the manufacturer's recommendations and as necessary to meet the specified fire rating requirements.
- D. Where firestopping is used to seal around penetrations through waterproof membranes, install to maintain integrity of waterproof barrier.
- E. At locations exposed to view in the finished work, place firestopping neatly in the annular space without over application to the adjacent surfaces. Mask surfaces as necessary to create a uniformly straight edge.
- F. Electrical Boxes:
  - 1. For sealing electrical boxes, coordinate installation with the electrical installer.
  - 2. Comply with manufacturer's recommendations for preparation and installation.
  - 3. Install in locations as required by Code for protection of openings through fire rated partitions.

### **3.03 CLEANING**

- A. Trim excess material flush with adjacent surface.
- B. Remove spills, leave area in undamaged, clean condition.

**END OF SECTION**

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## SECTION 07850

### FIRE RATED JOINTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
  - 1. Fire rated construction joint assemblies in fire-rated construction, including joints at the following locations:
    - a. Where partition heads meet the underside of overhead floor or roof construction.
    - b. Where floor and roof construction meets exterior perimeter wall construction.
  - 2. Requirements for fire rated construction joint assembly components provided in other Sections.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E119	Method for Fire Tests of Building Construction and Materials
ASTM E2393	Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
UL Standard 2079	Underwriters Laboratories: Tests for Fire Resistance of Building Joint Systems.
SBC	Seattle Building Code

- B. Fire Rated Joint Assemblies: Successfully tested in accordance with ASTM E119 as applicable to meet the hourly fire ratings of the construction being sealed.
- C. Fire rated joint assemblies at partition heads shall have been tested in accordance with the dynamic requirements of UL 2079, including hose stream test.
- D. VOC limits for Sealants and Primers: Conform to the requirements of the Southern California South Coast Air Quality Management District (SCAQMD) Rule 1168.
  - 1. Sealants: Maximum VOC content of 250 grams/liter.
  - 2. Primers: Maximum VOC content of 250 grams/liter for non-porous surfaces; 750 grams/liter for other surfaces.
- E. The fire rated joint systems shall be subject to Owner paid inspection. Inspection will be performed in accordance with the requirements of ASTM E2393.
- F. Where assemblies are shown which do not exactly conform to a tested assembly, the manufacturer of the fire rated joint system components shall provide an engineering judgment for the assembly to meet the requirements of the jurisdictional code authority.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Submit product data for proprietary fire rated materials and components.

- C. Submit drawings of each fire rated construction joint assembly proposed, showing components and installation details. Include test number.

#### **1.04 SYSTEM DESCRIPTION**

- A. Each fire rated construction joint assembly shall be selected to maintain fire rating of the assembly in which it used.
- B. Each fire rated construction joint assembly shall be resilient as necessary to accommodate differential movement between assemblies.

#### **1.05 ENVIRONMENTAL CONDITIONS**

- A. Environmental Requirements: Comply with manufacturer's recommendations for components.
- B. Where applicable, maintain maximum ventilation to remove volatile emissions produced during the installation process.

### **PART 2 PRODUCTS**

#### **2.01 FIRE RATED CONSTRUCTION JOINT ASSEMBLIES**

- A. Metal Stud / Gypsum Board Partition Head Construction Joint Assembly: Based on fire rated assemblies listed in the Drawings.
  - 1. Fire Rated Track: Composite/Track Firestop by BlazeFrame or Approved Equal.
  - 2. Provide slotted track unless approved otherwise; minimum 20 gage; widths as indicated.
  - 3. Gypsum Board: As specified in Section 09260.
  - 4. Packing material and fill, void, or cavity material per UL rated assemblies for dynamic wall head conditions as indicated in the Drawings.
  - 5. Provide flute covers, strap steel, and other components as required for the assembly.
- B. Concrete or Masonry Wall Partition Head Construction Joint Assembly at Metal Deck with Concrete Fill:
  - 1. System: UL System No. HW-D-0022, or approved; 2 hour fire rating at floors; 1 hour fire rating at roof deck.
  - 2. Forming Material: Preformed mineral fiber as listed in the UL assembly; minimum 4 PCF density.
  - 3. Fill, Void, or Cavity Material: "Firedam Spray" or "Fire Barrier Spray" by 3M; or Approved Equal.
- C. Metal Stud / Floor Edge Assembly:
  - 1. System: UL System No. CW-S-1003, or approved; 2 hour fire rating at floors; 1 hour fire rating at roof deck.
  - 2. Wall Insulation: Fiberglass batt as provided under Section 07210.
  - 3. Wall Insulation: Thermafiber Firespan by Thermafiber LLC or Approved Equal; mineral wool with foil-scrim facing; flame spread of 25 or less and a smoke developed of 0 when tested in accordance with ASTM E84; 8 pcf density; 2 inches and 1 inch at locations indicated.
  - 4. Forming Material: Thermafiber Safing Insulation by Thermafiber LLC or Approved Equal; unfaced mineral wool; minimum 4pcf density.
  - 5. Fill, Void, or Cavity Material: Spec Seal AS 200 Elastomeric Spray or Spec Seal Fastack Spray by Specified Technologies Inc. or Approved Equal.
  - 6. Installation Accessories: Angle clips, horizontal angles, impaling pins with sheet metal shields, and other components as listed in the assembly.
- D. Fill, Void, or Cavity Material: PENN 300 Silicone Joint Sealant, by Specified Technologies Inc., or Approved Equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 INSTALLATION OF FIRE RATED CONSTRUCTION JOINT ASSEMBLIES**

- A. Install fire rated construction joint assemblies in accordance with the fire rated assemblies listed, and as necessary to meet the specified fire rating requirements.
- B. Installation shall be continuous along the entire length of the rated assembly.
- C. Coordinate installation of integral components as necessary to ensure the fire rating of the assemblies.

### **3.03 CLEANING**

- A. Trim excess material flush with adjacent surface.
- B. Remove spills, leave area in undamaged, clean condition.

**END OF SECTION**

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## SECTION 07900

### JOINT SEALERS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies joint sealers and joint backing for general construction.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C919	Standard Practice for Use of Sealants in Acoustical Applications
ASTM C920	Specification for Elastomeric Joint Sealants
ASTM D1056	Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
1.	Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
2.	Perform acoustical sealant application work in accordance with ASTM C919.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Manufacturer's product data demonstrating compliance with the Specifications.
- C. Manufacturer's recommendations for storage, handling and application of sealants and primers.
- D. Samples of material proposed for use showing color range available.

##### 1.04 SYSTEM DESCRIPTION

- A. System performance: Achieve moisture and airtight joint seals.

##### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

#### PART 2 PRODUCTS

##### 2.01 SEALANTS

- A. Unless specified indicated, use polyurethane sealant for all areas:
  - 1. ASTM C920, Type S, Grade NS or P, Class 25, non-sagging or self-leveling as specified.
  - 2. Capable of withstanding movement up to 25 percent of joint width.

3. Acceptable Manufacturer:
    - a. Sika Chemical Corporation, "Sikaflex".
    - b. Mameco International, "Vulkem".
    - c. Approved Equal.
- B. Silicone Sealant for ceramic tile areas:
1. ASTM C920, Type S, Grade NS, Class 25, single component, non-sagging, and non-staining.
  2. Capable of withstanding movement up to 50 percent of joint width.
  3. Formulated to resist mold growth and repeated exposure to high humidity while retaining adhesion, flexibility and color.
  4. Acceptable Manufacturer:
    - a. Dow Corning Corporation, No 796.
    - b. General Electric, Sanitary Sealant.
    - c. Approved Equal.
- C. Silicone Sealant for glazing:
1. ASTM C920, Type S, Grade NS, Class 25, single component non-sagging, and non-staining.
  2. Capable of withstanding movement up to 50 percent of joint width.
  3. Acceptable Manufacturer:
    - a. Dow Corning Corporation, No 790.
    - b. General Electric, Silpruf.
    - c. Approved Equal.
- D. Acrylic Latex Sealant for interior joints at finishes not specified otherwise.
1. ASTM C834, Type S, Grade NS, Class
  2. Acceptable Manufacturer:
    - a. Tremco, Tremflex 834.
    - b. Pecora, AC-20.
    - c. Approved Equal.
- E. Bituminous Based Sealant for contact with wastewater:
1. Blend of refined asphalts, resins and plasticizing compounds, reinforced with fiber and asbestos-free.
  2. Compatible with joint fillers.
  3. Pressure grade.
  4. Acceptable Manufacturer:
    - a. Sika Chemical Corp., Sikaflex-2C.
    - b. Sonneborn, NP2 for non-sag or SL2 for self-leveling.
    - c. Approved Equal.

## 2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by the sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer, compatible with joint forming materials.
- C. Backer Rod: Closed cell polyethylene or polyurethane foam, cylindrical and oversized a minimum of 30 percent larger than joint width.
- D. Bond Breaker: Polyethylene or polyurethane with adhesive on one side as recommended by sealant manufacturer to suit application.



## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Remove loose materials and foreign matter, which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.

### **3.02 PREPARATION**

- A. Prepare, clean and prime joints in accordance with manufacturer's recommendations. Apply primer only to the surfaces that will be covered by the sealant.
- B. Mask adjacent surfaces where necessary to maintain neat edge.

### **3.03 GENERAL**

- A. Apply sealant in accordance with manufacturer's recommendations.
- B. Install joint backing when joints exceed the depth requirements. Insert backing to provide the joint depth specified. Provide full-length sections without splices where possible. Minimize number of splices.
- C. Install bond breaker where joint backing is not used.
- D. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Seal joints around window, door and louver frames, expansion joints, miscellaneous penetrations and elsewhere as indicated.
- F. Tool joints concave unless indicated otherwise.

### **3.04 POLYURETHANE SEALANT INSTALLATION**

- A. Unless otherwise indicated, use on expansion joints and construction joints:
  - 1. Use non-sag on vertical exposed joints.
  - 2. Use self-leveling on horizontal exposed joints.
- B. Joint dimensions: Unless otherwise indicated, construct joints to the following criteria:
  - 1. Width: Minimum 1/4 inch and maximum 1 inch.
  - 2. Depth: 1/2 the width of the joint, but in no case less than 1/4-inch deep. Measure sealant depth at the point of smallest cross section.

### **3.05 BITUMINOUS SEALANT INSTALLATION**

- A. Use at joints, which will be submerged under wastewater.
- B. Joint Dimensions: 2 inches deep, 1 inch wide at the top, and 3/4 inch wide at the base.

### **3.06 CLEANING**

- A. Clean adjacent surfaces of smears or other soiling resulting from sealant application.
- B. Replace damaged surfaces resulting from sealant application or cleaning.

### **3.07 PROTECTION**

- A. Protect sealants until cured.

**END OF SECTION**

# DIVISION 08

## DOORS AND WINDOWS

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## SECTION 08110

### STEEL DOORS AND FRAMES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies steel doors, frames and interior borrowed light frames including transoms; non-rated and fire rated.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI A117.1	Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People
ANSI/SDI 100	Standard Steel Doors and Frames
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process Standard
ASTM E413	Standard Steel Doors and Frames
UL 10B	Fire Tests of Door Assemblies
SDI 117	Manufacturing Tolerances for Standard Steel Doors and Frames
SDI / ANSI A250.6	Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
SDI / ANSI A250.4	Nomenclature for Standard Steel Doors and Steel Frames.
SDI / ANSI A250.8	(formerly SDI 100), Recommended Specifications for Standard Steel Doors and Frames.
SDI / ANSI A250.10	Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
SDI / ANSI A250.11	Recommended Erection Instructions for Steel Frames.

- B. National Association of Architectural Metal Manufacturers (NAAMM):  
1. Hollow Metal Manufacturers Association (HMMA).
- C. International Code Council (ICC):  
1. Seattle Building Code and associated standards, 2012 Edition including all amendments, referred to herein as Building Code.
- D. Qualifications: Manufacturer shall be current member of SDI, and NAAMM (HMMA).

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product data sheets.
- C. Manufacturers' storage, handling, and installation instructions.

- D. Shop drawings, indicating:
  - 1. Door and frame elevations.
  - 2. Internal reinforcement.
  - 3. Cut-outs for glazing and finish.
  - 4. Identification of each door: Noted with the same reference indicated in the Drawings.

#### **1.04 DELIVERY, STORAGE AND HANDLING**

- A. Deliver doors and frames in packaging to prevent damage and deterioration.
- B. Store doors upright, in dry, protected area. Place at a minimum of 1 inch above ground and space at least 1/4 inch apart.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. Provide products of one manufacturer to achieve standardization of appearance, operation, maintenance and spare parts.
- B. Acceptable Manufacturers:
  - 1. Ceco Door Products.
  - 2. Curries Manufacturing.
  - 3. Overly Manufacturing Co.
  - 4. Republic Steel Corporation.
  - 5. Steelcraft Manufacturing Co.
  - 6. Approved Equal.

#### **2.02 DOORS AND FRAMES**

- A. General:
  - 1. SDI/ANSI A250.8.
  - 2. Fabricate rigid, neat in appearance and free from defects.
  - 3. Form to sizes and profiles indicated in the Drawings.
  - 4. Beveled edge.
  - 5. Fit and assemble in shop wherever practical.
  - 6. Mark work that cannot be fully assembled in shop to assure proper assembly at site.
  - 7. Continuously wire weld all joints, dress exposed joints smooth and flush.
  - 8. Fabricate doors and frames to tolerance requirements of SDI 117.
  - 9. Fit doors to SDI clearances.
    - a. Exterior doors: Seal weld top cap to door face and grind smooth and flush.
    - b. Interior doors:
      - 1) Attach top cap to door with concealed fasteners or by welding.
      - 2) Factory seal if attached with fasteners.
      - 3) No exposed fasteners will be accepted.
  - 10. Continuously wire weld all joints and dress, smooth and flush.
- B. Frames:
  - 1. 16-gage, welded type.
  - 2. Finished size, shape, cross section and profile as indicated in the Drawings.
  - 3. Fabricate with hardware reinforcement welded in place.
  - 4. Prepare frames for silencers and install.
  - 5. Provide 4 IN face at head where indicated in the Drawings or required by wall construction.
  - 6. 26 GA galvanized steel boxes welded to frame at back of all hardware cutouts.

7. Steel plate reinforcement welded to frame for hinge, strikes, closers and surface-mounted hardware reinforcing.
8. All plate reinforcement shall meet size and thickness requirements of SDI/ANSI A250.8.
9. Split type frames not acceptable.
10. Conceal all fasteners.
11. Frames shall be set up, all face joints continuously wire welded and dressed smooth.
12. Exterior (up to 4 FT wide): 16 GA.
13. Exterior (over 4 FT wide): 14 GA.

C. Doors:

1. 16-gage face, ANSI/SDI-100 Grade III, Extra Heavy Duty, Model 1, with honeycomb or polyurethane core.
2. Exterior doors shall have polyurethane core, R-value of 7 measured in accordance with ASTM E413. Configure doors to receive recessed weather-stripping.
3. Provide top and bottom flush closures.
4. Fabricate with the required reinforcement for specified hardware
5. General:
  - a. 1-3/4 IN thick.
  - b. Fabricate with flush top caps.
  - c. Thickness and material to match door face.
6. Exterior:
  - a. SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.
    - 1) Face sheet minimum thickness: 16 GA.
    - 2) Insulated: Minimum R10.
7. Interior:
  - 1) SDI/ANSI A250.8, Level 2, and physical performance level "B", Model 2.
    - a) Face sheet minimum thickness: 18 GA.
8. Sound insulated, minimum STC-35.
9. Design and fabricate doors to requirements of the Building Code.
10. Fire Rated Doors:
  - a. Comply with requirements of UL.
  - b. UL label each door and frame for class of rating scheduled.
11. Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and SDI/ANSI A250.6.
  - a. Locate finish hardware in accordance with SDI/ANSI A250.8.
  - b. See Specification Section 08710 for hardware.
  - c. Prepare doors for swing direction indicated.
  - d. Preparing doors for non-handed hinges is not acceptable.
  - e. All doors shall be handed.
  - f. Hinge cut-out depth and size on doors and frames shall match hinge specified in Section 08710.

D. Interior Windows: fabricated in the same manner as other frames and provided with glazing stops.

## 2.03 DOOR LOUVERS

- A. Stationary louvers: inverted "Y" design, 1 inch thick, of 18-gage steel, with metal molding on both sides.
- B. Acceptable Manufacturer:
  1. Airolite.
  2. Panelouvre.
  3. Custom Architectural Products.
  4. Approved Equal.

## **2.04 PROVISIONS FOR GLAZING**

- A. Furnish doors with formed glazing strips of snap-in type to permit selection of secure side in the field. No screws allowed.
- B. Accommodate glass of type and thickness indicated and as specified in Section 08800.

## **2.05 FACTORY FINISH**

- A. Steel Sheet: Hot-dipped galvanized steel, ASTM A653, A60 coating.
- B. Frames: Hot-dipped galvanized steel, ASTM A653, A60 coating.
- C. Supports and Reinforcing: Hot-dipped galvanized steel, ASTM A653, A60 coating.
- D. Inserts, Bolts and Fasteners: Manufacturer's standard.
- E. Primer: Manufacturer's standard coating meeting SDI/ANSI A250.10.
- F. Thermal Insulation: Polyurethane, CFC free.
- G. Sound Insulation: Fiberglass batt insulation or impregnated Kraft honeycomb.
- H. Frame Anchors:
  - 1. Jamb anchors:
    - a. Masonry wire anchors: Minimum 0.1875 IN wire, galvanized.
    - b. Existing wall anchor: Minimum 18 GA, galvanized.
    - c. Stud partition and base anchors: Minimum 18 GA, galvanized.
- I. Phosphate treat for paint adhesion.
- J. One coat, not less than one mil dry film thickness, baked-on rust inhibiting primer compatible with finish coating as specified in Section 09900.

## **2.06 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install doors and frames in accordance with ANSI/SDI 100, SDI / ANSI A250.11, the Building Code and manufacturer's instructions.
- B. Plumb, align, and brace frames securely until permanently anchored.
  - 1. After completion of walls, remove temporary braces and spreaders.
  - 2. Anchor frames with minimum of three (3) anchors per jamb.
    - a. Number and location of anchors shall be in accordance with SDI and frame manufacturer's recommendations.
- C. Maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.
- D. Coordinate with masonry and wallboard wall construction for frame anchor placement.



- E. Fill frames installed in CMU or concrete construction with grout. Use horizontal spreaders to keep jambs from bowing in as frames are being filled with grout.
- F. Use plastic plugs to keep silencer holes clear during construction.
- G. Immediately after erection, sand smooth rusted or damaged areas.
  - 1. Touch-up with rust-inhibiting primer.
  - 2. Leave finish smooth for finish painting per Section 09900.
- H. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached.
- I. Install three (3) silencers on strike jamb of single door frame and two (2) on head of double door frame.
- J. Coordinate installation with installation of hardware specified in Section 08710.
- K. Coordinate installation of glass and glazing.

### **3.02 ADJUSTING**

- A. Adjust door for smooth and balanced door movement.

**END OF SECTION**

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**SECTION 08310**  
**ACCESS HATCHES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies furnishing and installing factory fabricated access hatches.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following document. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and that of a listed document, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A36	Standard Specification for Structural Steel
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
Occupational Safety & Health Administration (OSHA): 29 CFR 1910.23	Fall Protection in General Industry

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Provide manufacturer's product data for all materials in this Section.
- C. Shop drawings: Show profiles, accessories, location, and dimensions.
- D. Samples: Manufacturer to provide upon request; sized to represent material adequately.
- E. Contract Closeout: Vault access door manufacturer shall provide the manufacturer's Warranty prior to the Contract closeout.

**1.04 PRODUCT HANDLING**

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area. Thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

**1.05 JOB CONDITIONS**

- A. Verify that other trades with related work are complete before installing vault access door(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Comply with the construction documents, shop drawings, and manufacturer's installation instructions.

## **PART 2 PRODUCTS**

### **2.01 SIDEWALK DOORS**

- A. Acceptable Manufacturers:
  - 1. Bilco Co., New Haven, CT; J Series.
  - 2. Nystrom Building Products Co., Minneapolis, MN; FG Series.
  - 3. U.S.F. Fabrication, Hialeah, FL; T Series.
  - 4. Flyght Corp., Trumbull, CT; FDRN Series.
  - 5. Thompson Fabricating Co., Birmingham, AL; TE Series.
  - 6. Halliday Products, Orlando, FL; WS Series.
  - 7. Approved Equal.
- B. Load Capacity: 300 psf with maximum deflection of  $1/150^{\text{th}}$  of span. Provide H-20 highway loading capacity where indicated in the Drawings.
- C. Component Fabrication:
  - 1. Access Door Leaf(s): 1/4-inch aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for both ends with snap hook of double-leaf door assembly when open.
  - 2. Channel Frame: 1/4-inch thick extruded aluminum trough frame with continuous anchor flange around perimeter. Weld 1-1/2-inch diameter drain coupling to frame trough, unless otherwise indicated in the Drawings.
  - 3. Safety Grate: Aluminum grating with 300 psf live load capacity, 5-inch by 5-inch grate openings, permanent hinging system that locks grate in 90-degree position, and opening arm with vinyl grip handle and locking device.
- D. Door Hardware:
  - 1. Hinges: Heavy-duty brass or Type 316 stainless steel with stainless steel pins through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
  - 2. Lifting Mechanism: Type 316 stainless steel compression lift springs enclosed in telescoping vertical housing or Type 316 stainless steel torsion lift springs.
  - 3. Hold-Open Arm:
    - a. Locks automatically in open position.
    - b. Disengages with slight pull on vinyl grip with one hand.
    - c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.
  - 4. Snap Lock:
    - a. Type 316 stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
    - b. Threaded plug for flush outside surface with key wrench removed.
- E. Aluminum shall be mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09900.

### **2.02 FLOOR HATCHES**

- A. Acceptable Manufacturers:
  - 1. Bilco Co., New Haven, CT; K Series.
  - 2. Nystrom Building Products Co., Minneapolis, MN; FH Series.
  - 3. U.S.F. Fabrication, Hialeah, FL; A Series.
  - 4. Flyght Corp., Trumbull, CT; FLE Series.
  - 5. Thompson Fabricating Co., Birmingham, AL; TI Series.
  - 6. Halliday Products, Orlando, FL; SS Series.
  - 7. Approved Equal.

- B. Load Capacity: 150 psf in foot traffic areas and 300 psf in light vehicular traffic area with maximum deflection of 1/150th of span.
- C. Component Fabrication:
  - 1. Access Door Leaf(s): 1/4-inch thick aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.
  - 2. Angle Frame: 1/4-inch thick extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip.
  - 3. Safety Grate: Aluminum grating with 300 psf live load capacity, 5-inch by 5-inch grate openings, permanent hinging system that locks grate in 90-degree position, and opening arm with vinyl grip handle and locking device.
- D. Door Hardware:
  - 1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins, through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
  - 2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.
  - 3. Hold-Open Arm:
    - a. Locks automatically in open position.
    - b. Disengages with slight pull on vinyl grip with one hand.
    - c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.
  - 4. Snap Lock:
    - a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
    - b. Threaded plug for flush outside surface with key wrench removed.
- E. Aluminum shall be mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09900.

## **PART 3 EXECUTION**

### **3.01 EXISTING CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

### **3.02 INSTALLATION**

- A. Submit product design drawings for review and approval to the Project Representative before fabrication.
- B. Check as-built conditions and verify the manufacturer's vault access door details for accuracy to fit the application prior to fabrication. Comply with the vault access door manufacturer's installation instructions.
- C. Furnish mechanical fasteners consistent with the vault access door manufacturer's instructions.

### **3.03 ADJUSTING AND CLEANING**

- A. Adjust doors and hardware after installation for proper operation.

- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION**

## **SECTION 08330**

### **OVERHEAD COILING DOORS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section specifies:
  - 1. Overhead coiling doors.
  - 2. Support framing.

##### **1.02 QUALITY ASSURANCE**

- A. Installers: Trained and authorized by the door manufacturer.
- B. Pre-Installation Conference:
  - 1. Conduct in accordance with Section 01200.
  - 2. Require in attendance the General Contractor, the Project Representative, the overhead door subcontractor, the electrical subcontractor, and others as may be affected by the work of this Section.
  - 3. Agenda: Address coordination, existing conditions, switch locations, connection points, baffle installation, access requirements, motor locations, and field testing procedures.

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data: Submit manufacturer's complete product literature indicating specified items and method of installation.
- C. Shop drawings: Indicate details and dimensions of installation, including tracks, supports, connection points and details, and locations of operating components.

##### **1.04 SYSTEM DESCRIPTION**

- A. Overhead coiling door assembly includes curtain, curtain guides, brackets, counterbalance, hood, motor operators as specified, push button stations, steel structural supports and other accessories required for a complete installation.
- B. Exterior rolling service doors shall be designed to withstand a minimum 20 pounds per square foot windload, in addition to design loads indicated in the Structural Drawings. Windlocks shall be installed on 22 and 20 gauge doors over 8 feet 1 inch wide and on 18 gauge doors over 14 feet 1 inch wide.
- C. Rolling service doors shall be designed to a standard maximum of 20 cycles per day and an overall maximum of 50,000 operating cycles for the life of the door.

#### **PART 2 PRODUCTS**

##### **2.01 ACCEPTABLE MANUFACTURERS**

- A. The Cookson Company.
- B. Overhead Door Corporation.

- C. Wayne Dalton Corporation.
- D. Cornell Iron Works Incorporated.
- E. McKean Rolling Door Company.
- F. Approved Equal.

## **2.02 PREMANUFACTURED DOOR ASSEMBLIES**

- A. Type 1: Motorized Non-Rated Doors.
  - 1. Cookson Type FCM; motorized operation.
  - 2. Motor Operator: Heavy duty gear head motor operator; 3 phase power; 460V.
  - 3. Curtain: Galvanized steel curtain; No 5 slat design; factory primed finish.
  - 4. Reversing footpiece; provide concealed self-winding electrical cord reel; located directly above connection point on bottom-bar. Bottom-bar switch shall be detailed and mounted so as not to overhang the bottom-bar angle.
  - 5. Provide weather-stripping at exterior doors.
  - 6. Key operated switch, constant pressure (spring return) type, labeled "OPEN" and "CLOSE," with center off position; keyed cylinder to be furnished under Section 08710.
- B. Type 2: Motorized Insulated Non-Rated Doors:
  - 1. Cookson Type FMWI; motorized operation.
  - 2. Motor Operator: Heavy duty gear head motor operator; 3 phase power; 460V.
  - 3. Curtain: Galvanized steel curtain with polyurethane insulated slats; factory primed finish.
  - 4. Reversing footpiece; provide concealed self-winding electrical cord reel; located directly above connection point on bottom-bar. Bottom-bar switch shall be detailed and mounted so as not to overhang the bottom-bar angle.
  - 5. Weatherstripping at exterior doors.
  - 6. Key operated switch, constant pressure (spring return) type, labeled "OPEN" and "CLOSE," with center off position; keyed cylinder to be furnished under Section 08710.

## **2.03 SUPPORT FRAMING**

- A. Provide tube steel framing as indicated to support the overhead coiling doors.
- B. Design the support framing.
- C. Provide bracing, attachments, and anchors to adjacent structure to maintain the installation firmly in position.
- D. Framing shall be designed to accommodate deflection from the structure above without transmission of the load to the structure below.
- E. Design framing system to meet the seismic requirements of the City of Seattle Building Code.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.



- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of Site conditions and responsibility for defective installation caused by prior observable conditions.
- C. Verify that openings are prepared with headers level, jambs plumb, floor level, without projections, and are correctly dimensioned to receive door.

### **3.02 INSTALLATION**

- A. Install door assemblies as indicated in accordance with manufacturer's installation instructions, and the labeling requirements. Labeling requirements take precedence over other requirements.

### **3.03 FIELD QUALITY CONTROL**

- A. Verify that moving parts operate smoothly, coiling doors are free from warp, twists, or distortion, doors remain in required position, and safety features function properly.
- B. Repair damage to overhead coiling doors to match manufacturer's original finish. Replace components which cannot be properly repaired.

### **3.04 ADJUST**

- A. Adjust mechanism so moving parts operate smoothly.

**END OF SECTION**

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## SECTION 08400

### ALUMINUM FRAMED GLAZING SYSTEMS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
1. Aluminum framed curtain wall systems.
  2. Aluminum framed glass entrance doors integral with aluminum framed glazing systems.
  3. Glazed-in operable windows and operators.
  4. Interior Aluminum Storefront Systems.
  5. Sealants within aluminum framed glazing systems.
  6. Related flashing and trim.
  7. Related anchor brackets and supports.
  8. Structural design of aluminum framed glazing systems, including framing and attachment to structure.
  9. Hardware for entry doors, including low energy operators.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
AAMA 501.2	American Project Architectural Manufacturers Association. Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.
AAMA 2605	American Project Architectural Manufacturers Association. Voluntary Specification for Performance Requirements and Test Procedures for Superior Performance Organic Coatings on Project Architectural Extrusions and Panels.
ANSI A156.19	American National Standard for power Assist and Low Energy Power Operated Doors.
ANSI Z97.1	American National Standard for Performance Specifications and Test Methods for Safety Glazing Materials in Buildings.
ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate.
ASTM B221	Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C1401	Standard Guide for Structural Sealant Glazing.
ASTM E283	Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
ASTM E330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls.
ASTM E331	Test Method for Water Penetration of Exterior Windows, Curtainwalls, and Doors by Uniform Static Air Pressure Difference.
NERC 100	Procedure for Determining Fenestration Product U-Factors.
NFRC 102	National Fenestration Rating Council: Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems
NFRC 200	National Fenestration Rating Council: Solar Heat Gain Coefficient and Visible Transmittance.

- B. Installers: Under the direct supervision of the manufacturer of the aluminum framed glazing system.

- C. Structural Design: Structural design of the aluminum framed glazing systems shall be by a Structural Engineer registered in the state of Washington.
- D. Structural welding shall be performed by AWS Certified welders.
- E. All materials shall conform to the Metal Curtain Wall Guide Specifications as published by the Project Architectural Aluminum Manufacturer's Association.
- F. Regulatory Requirements:
  - 1. Framing system shall meet the requirements of the City of Seattle and the Authority Having Jurisdiction (AHJ).
  - 2. Furnish calculations, engineer's stamps, drawings, and other items required by the AHJ to obtain approval of the installation.
- G. Mockup:
  - 1. Construct mock-up in place as indicated in Drawings or as otherwise indicated by the Project Representative. Include the following:
    - a. Cast-in-place concrete as specified in Section 03300.
    - b. Sheet metal siding as specified in Section 07410.
    - c. Sanded and unsanded sealant joint; Section 07900.
    - d. Aluminum framed glazing system as specified in this Section.
    - e. Insulating glazing as specified in Section 08800.
    - f. Water repellent coating on concrete; Section 07191.
  - 2. Mock-up review will include inspection of workmanship, tolerances, flashing details, coatings, mortar, and sealant colors, and other items pertaining to compliance with the Contract Documents and design intent.
  - 3. Approved mock-ups made become part of the Work.
- H. Exterior Structural Glazing:
  - 1. Submit exterior structural glazing designs to sealant manufacturer for analysis. Submit matching sample materials, and all other data and components for testing as required by the manufacturer.
  - 2. Obtain written approvals and recommendations for the structural glazing design systems from the structural glazing sealant manufacturer.
  - 3. Structural Sealant Glazing: Comply with ASTM C1401 for design and installation.
- I. Pre-Installation Conference:
  - 1. In accordance with Section 01200, schedule and administer a meeting to review and discuss the aluminum framed glazing system installation a minimum of two weeks (14 days) prior to start of installation.
  - 2. Require in attendance, the Contractor, the Project Representative, the aluminum framed glazing system subcontractor, and other parties affected by work of this Section.
  - 3. Agenda: Discuss relevant topics concerning the aluminum framed glazing system installation, including without limitation, the following:
    - a. Storage and delivery of materials.
    - b. Scheduling and preparation.
    - c. Installation access.
    - d. Installation tolerances.
    - e. Support framing.
    - f. Integration with air barrier and other adjacent construction.
    - g. Protection.
    - h. Touch-up and cleaning.

### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.

- B. Product Data: Manufacturer's complete product for components and systems proposed.
- C. Shop drawings:
  - 1. Elevations, system dimensions, and expansion and contraction joint location.
  - 2. Special and typical details.
  - 3. Framing profiles.
  - 4. Materials and finishes.
  - 5. Adjacent construction.
  - 6. Anchorage system details.
  - 7. Fastening methods.
  - 8. After receipt of approval, shop drawings shall be prepared, stamped, dated, and signed by a Professional Structural Engineer registered in the state of Washington.
- D. Manufacturer's Assembly Instructions: Submit manufacturer's standard written and graphic assembly instructions for each system to be provided. Show assembly procedures and sequences recommended by the manufacturer to meet the performance requirements specified.
- E. Samples:
  - 1. Submit one sample of a typical window corner section with minimum 12 inch long legs. Finish to match Project Representative's sample. Include typical glass unit and glazing system.
- F. Quality Control Submittals: In accordance with Section 01300.
  - 1. Test Reports: Submit copies of test reports which verify that each aluminum framed glazing system meets the air and water infiltration performance requirements specified.
  - 2. Certification: Submit written certification that the framing system has been designed to meet the specified requirements.
  - 3. Where structural design is not furnished, submit certified test report data verifying structural compliance of systems similar to those to be provide and having spans greater than or equal to the spans indicated in the Drawings. Tests shall have been performed by an AAMA certified testing laboratory in accordance with ASTM E330 requirements.
- G. Energy Performance Certification: For each aluminum-framed glazing system and glazing combination.
  - 1. NFRC-certified energy performance values for each system, including U-value, SHGC, and Visible Light Transmittance. Evidence for Certification:
    - a. NFRC Label with Certified Product Directory (CPD) number.
    - b. NFRC Label Certificate.
- H. Closeout Submittal
  - 1. In accordance with Section 01300.
  - 2. Submit designing engineer's certification that products and installation comply with design requirements.

#### **1.04 SYSTEM DESCRIPTION**

- A. Appearance: System shall conform to the general appearance as indicated in the Drawings, including without limitation, position, spacing, and location of framing members, plane of glazing, exterior frame general profile and shape, and dimension points.
- B. Energy Performance: Certify and label energy performance according to NFRC as follows:
  - 1. Thermal Transmittance (U-factor): Glazing and framing areas shall have U-factor of not more than the following, as determined according to NFRC 100.
  - 2. Curtain Walls:
    - a. SSG Curtainwall (CWSSG): 0.36.
  - 3. Operable Aluminum Windows and Vents (AV): 0.40.
  - 4. Glazed Aluminum Entrance Doors: 0.60.

- C. Solar Heat Gain Coefficient:
  - 1. Glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
  - 2. Glazed entrance doors shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
- D. Performance - Air Infiltration:
  - 1. Air Infiltration Storefront, Window, and Curtain Wall Systems: Not to exceed 0.06 CFM per square foot of fixed area when tested in accordance with ASTM E283 at a static pressure differential of 1.57 PSF.
  - 2. Air Infiltration Aluminum Entrance Doors: Limit air infiltration through assembly to 1.0 CFM per square foot, measured at a static differential pressure of 1.57PSF as measured in accordance with ASTM E283.
- E. Performance - Water Penetration:
  - 1. Design systems to drain water, including condensation, to the exterior.
  - 2. Water Penetration – Curtain Wall System: System shall remain watertight when tested in accordance with ASTM E331, at a test pressure of 12 PSF.
- F. Structural Design:
  - 1. Design and size members to withstand positive and negative wind loads as indicated in the Structural Drawings.
  - 2. System shall limit framing deflection to 1/175 of the span, and allowable stress within a safety factor of 1.65, whichever is greatest, under wind load as indicated in the Structural Drawings.
  - 3. Anchorages and inserts shall be designed to resist design and live loads, in combinations as specified, and including a contribution of 1.25 x the design wind load.
  - 4. Seismic Design: The installed system shall be capable of accommodating seismic loads in compliance with code requirements.
- G. Dynamic Movement: System shall accommodate the following without damage to system components or performance.
  - 1. Movement within the system.
  - 2. Movement between the system and perimeter framing components.
  - 3. Application and release of design live loads.
  - 4. Deflection of structural support framing.
  - 5. Thermal movement caused by a temperature range of -20 degrees F. to + 160 degrees F. without detrimental effects to components, sealing systems, and surrounding construction.
- H. Under normal circumstances, systems shall not exhibit vibration harmonics, wind whistles, and noises caused by thermal movement. Under the full range of design loads and conditions, the systems shall not exhibit loosening, weakening, or fracturing of attachments or components of the system, including glazing and sealants.

## **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Extruded Aluminum: ASTM B221; 6063 T5 alloy and temper.
- B. Sheet Aluminum: ASTM B209; 5005-H32 alloy, or Approved Equal.

### **2.02 SYSTEMS**

- A. Approved Manufacturers:
  - 1. Kawneer.
  - 2. Approved Equal.
- B. Aluminum Curtain Wall Framing: Kawneer 1600 UT System 2, or Approved Equal; 2-1/2 x 7-1/2 inch section.
  - 1. Refer to Curtain Wall Legend for locations and extents.
- C. Interior Aluminum Framing: Kawneer InFrame System or Approved Equal; 2 x 4-1/2 inch section; center set; flush design.
- D. Aluminum Storefront Doors: Kawneer "AA250," or Approved Equal; narrow stile; 10 inch bottom rail.
- E. Operable Aluminum Windows:
  - 1. Basis of Design: Kawneer "GLASSvent UT," or Approved Equal; 1" clear insulating glass; project-out; include cam handle.
  - 2. Conform to requirements of AAMA/NWDA 101/I.S.2-97 classification HC-40 for types indicated.
  - 3. Vent frames shall be extruded aluminum. Tube perimeter shall be continuous aluminum with thermal break construction.
  - 4. Weatherstrips shall have a continuous spline engaged in a continuous groove in the frame. Provide two continuous lines of weatherstrip at vent perimeters. Weatherstrips shall be extruded neoprene.
  - 5. Hinges shall be four-bar stainless steel type 302 or 304 with adjustable friction shoe. Provide 2 hinges per vent which comply with AAMA 904.1

### **2.03 COMPONENTS**

- A. Swing Door Hardware:
  - 1. Weatherstripping: Manufacturer's standard.
  - 2. Remaining hardware is specified in Section 08710.
- B. Low Energy Operator:
  - 1. Manufacturer: Horton Automatics, or Approved Equal.
  - 2. Operating Mechanism: "Series 4800 LE Series Electric Operator"; concealed overhead mounting; isolated pivot; 90° opening.
  - 3. Pushbutton Switch: Horton "C1260-5 Push Plate Switch" and plate sub-assembly; recessed configuration in 4x4 junction box with 4.5" x 4.5" square brushed stainless steel push plate with engraved and contrasting color paint filled handicap insignia and message "PRESS TO OPEN"; weatherproof for exterior installations. Furnish two per opening. Provide signage to indicate which push plate operates which door.
  - 4. Header Housing: Provide manufacturer's standard extruded aluminum header to receive power assist operator.
  - 5. Doors with low energy operators shall conform to the currently enforced edition of ANSI A156.19.

- C. Glazing Accessories:
  - 1. Gaskets for Stopped in Glazing: Furnish frame manufacturer's standard corner sealing resilient elastomeric, glazing gaskets for installation as a part of the work of Section 08800.
  - 2. Remaining glazing accessories are specified in Section 08800.
- D. Glass: As specified in Section 08800.
- E. Prefinished Metal Infill Panel: MapeShape Panel by Mapes Industries Inc. or Approved Equal. 2 inch thickness; polyisocyanurate foam core with high density polypropylene substrates; aluminum faces both sides; prefinished to match aluminum framed glazing system.
- F. Sealants: As specified in Section 07900.
- G. Fasteners: ASTM B633; aluminum, stainless steel, or zinc plated steel.

## **2.04 ALUMINUM FRAMED GLAZING SYSTEMS FABRICATION**

- A. Fabricate frames allowing for shim spacing around perimeter of assembly, yet enabling installation.
- B. Insofar as practical, fitting and assembly of the work shall be performed in the shop.
- C. Make joints flush, uniform, hairline (maximum 1/16 inch, except for expansion joints), and weatherproof. Seal joints with sealant.
- D. Rigidly fit joints and corners. Accurately fit and secure corners tight. Make corner joints flush, uniform, hairline (maximum 1/16 inch, except for expansion joints), and weatherproof. Seal joints with sealant.
- E. Provide drainage holes to allow water to flow to exterior.
- F. Prepare components to receive anchorage devices. Fabricate anchorage items.
- G. Provide internal reinforcement in mullions with members to maintain rigidity. Provide reinforcing at door strike jambs.
- H. Fabricate framing systems to accommodate hardware using templates furnished from the hardware supplier.
- I. Fabricate sill and other flashing to direct water to the exterior.
- J. At storefront systems, provide special extrusions or sealed backing plates as necessary to form a solid watertight surface to receive and support sealing systems as specified in Section 07900.

## **2.05 FINISHES**

- A. Color Anodized Finish: Apply at aluminum framing member surfaces exposed to view in installed position, and to sheet metal flashings.
  - 1. Conform to AAMA AA-M10C21A44.
  - 2. Architectural Class I, etched, medium matte, "Black" (Kawneer#29) color anodic coating, 0.7 mil thickness.
- B. Steel Anchorages and Supports: Clean and apply rust resistant primer.
- C. Isolate aluminum from dissimilar materials.



## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting Work, carefully inspect installed work of other trades and verify that such Work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Coordinate dimensions, tolerances, and method of attachment with the other Work.
- B. Furnish inserts for placement by other trades. Coordinate locations and alignment.

### **3.03 INSTALLATION**

- A. Install frames, doors, and hardware in accordance with manufacturer's instructions and the reviewed shop drawings.
- B. Use anchorage devices to securely attach framing systems to structure.
- C. Align frames plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
- D. Perimeter sealant is provided under Section 07900.
- E. Low Energy Operators:
  - 1. Install operators and controls in accordance with manufacturer's instructions and ANSI requirements.
  - 2. Coordinate electrical service, wiring and connections with work of Division 16.
- F. Install additional framing as necessary to support the system components.
- G. Protect aluminum from dissimilar materials with a coating of bituminous paint, plastic separator materials, or isolation tape. Keep isolation materials unexposed to view.

### **3.04 INSTALLATION TOLERANCES**

- A. Variation from Plane: 0.06 inches every three feet maximum or 0.25 inches per 100 feet, whichever is less.
- B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

### **3.05 FIELD QUALITY CONTROL**

- A. Static Water Penetration Test:
  - 1. Provide in-place performance testing of the exterior aluminum framed glazing systems in a minimum of two locations as directed by the Project Representative.
  - 2. Expedite work in the test areas in order to allow evaluation as early as possible during the construction schedule. Provide materials and personnel for prompt construction of test areas.

3. The various stages of construction of work and the testing thereof are subject to observation by the Project Representative, so that components are reviewed and installation details evaluated prior to proceeding with the next sequence. Notify the Project Representative when construction commences in these areas.
  4. Test Description:
    - a. Test areas shall be within one floor. Provide access to the interior surface of the tested surfaces in order to observe possible water penetration.
    - b. Test a minimum of 100 square feet of area, unless approved otherwise.
    - c. Coordinate schedules directly with the Project Representative, and testing laboratory. Notify the Project Representative a minimum of 5 days prior to testing.
    - d. Test Procedure:
      - 1) Uniform Static Pressure in accordance with ASTM E-1105 at 8 PSF.
      - 2) Result: There shall be no observable uncontrolled water leakage into the interior of the space.
  5. Corrections:
    - a. Correct components and assemblies that do not conform to Contract requirements.
    - b. Retest corrected assemblies until no failures occur under test.
    - c. Incorporate reviewed corrective changes in the construction of existing and remaining Work.
    - d. Where corrective changes have been incorporated into existing work, provide at least one additional test in an area as reviewed by the Project Representative and the envelope consultant.
- B. Engineer's Certification of Installation: The structural design engineer or authorized representative shall visit the Site to inspect the Work. Verify and certify that the installation has been installed in accordance with the structural requirements.

### **3.06 CLEANING**

- A. Remove protective material from prefinished aluminum surfaces if applicable.
- B. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

### **3.07 FIELD INSPECTION**

- A. The structural design engineer or an authorized representative shall visit the Site to inspect the Work. Verify and certify that the installation has been installed in accordance with the structural requirements.

### **END OF SECTION**

## **SECTION 08710**

### **FINISH HARDWARE**

#### **PART 1 GENERAL**

##### **1.01 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. Electronic Hardware Coordination: Coordinate Work of this Section with the requirements of systems specified under Divisions 16 and 17, as required to provide materials, fabrication, and installation for complete and operating system meeting the operational requirements stated.

##### **1.02 REFERENCES**

- A. Standards: Current edition at date of bid.
  - 1. ADAAG - Americans with Disabilities Act, "Accessibility Guidelines for Buildings and Facilities".
  - 2. ANSI/BHMA A156.18 - Materials and Finishes.
  - 3. NFPA 80 - Standard for Fire Doors and Windows.
  - 4. Underwriters Laboratories - Building Materials Directory.
  - 5. UL 10C - Underwriters Laboratories, "Positive Pressure Fire Tests of Door Assemblies".
  - 6. ICC/ANSI A117.1 "Accessible and Usable Building and Facilities".
- B. Codes:
  - 1. Washington State Building Code, Chapter 51-50 WAC.

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300..
- B. Product Data: Submit manufacturer's data for each item of finish hardware.
- C. Hardware Schedule: Submit detailed Door Hardware Schedule.
  - 1. The submitted Door Hardware Schedule shall indicate the complete designation of every item required for each door or opening.
  - 2. Furnish cover sheet listing title of project as shown on the Contract Documents, name, address, phone and fax numbers of Owner, Architect, Contractor, and Supplier, name of Certified Hardware Consultant, and date of submittal.
  - 3. List each opening individually under separate headings in the same order as the door schedule. Do not group like or similar doors under a single heading. Do not continue headings on separate pages.
  - 4. Each heading shall indicate opening location, handing, degree of opening, door size, type, fire rating, and Door and Frame material.
  - 5. Indicate product Manufacturer and incorporate cross-reference to symbols used in Article 2.15 Hardware Groups.
  - 6. Include an index indicating door, heading, and page numbers and locking function for each opening.
  - 7. Locations shall be included and miscellaneous hardware items.
  - 8. A cross reference for abbreviations or symbols used shall be included.
  - 9. Schedules in coded or horizontal format are unacceptable.

10. Submittals not conforming to these requirements will be returned without review, for re-submittal. Following is an example of the required format:

1 Sgl. Door #104 - Reception 100 to Office 104		LH 90°	
HW-2	3-0 x 7-0 x 1-3/4" x 20 Minute x Type C	SC WD x HMF	
3	Each Butts	MC	TA2714 US26D (652) 4.5 x 4.5 x 1/2MS
1	Lockset	SC	L9050R 17B 630 LH
1	Door Closer	LCN	4040XP Alum./689 x Hinge Face Mtg. x STB
1	Kick Plate	TI	B4EKP - 10 x 34.5 - US32D x B4E x CTSK
1	Wall Stop	TR	1270CX US26D (626)
1	Set Smoke Gasket	PE	S88D - 17' per Set

- D. Processing: Hardware schedules will not be reviewed by the Project Representative until they have been reviewed and approved by Contractor.
- E. Revisions: The Door Hardware Submittal shall be kept current throughout the project duration. Revisions incorporated shall be submitted in accordance with the above requirements. Submit only cover sheet and revised pages. Clearly identify changes from previous submittal content.
- F. Samples: If requested by the Project Representative, submit one (1) sample of each exposed hardware category, finished as required, and tagged with full description for coordination with the hardware schedule. Samples will be reviewed, by the Project Representative, for design and finish only, compliance with other requirements is the responsibility of the Contractor. Units which are acceptable and remain undamaged through submittal procedures may be used on the Project.
- G. Color Samples: Submit color charts and physical samples of each product requiring color selection.
- H. Key Schedule: Upon completion of the Key meeting, submit a key schedule indicating the complete project key system for approval. Obtain approval prior to proceeding with lock portion of the project.
- I. Operations and Maintenance Data.
  - 1. Submit Maintenance and Operations Manuals under the provisions of Section 01730, Project Close Out.
  - 2. Manuals shall contain final copy of the Door Hardware Submittal, Product Data, Parts Lists and Diagrams, Key Schedule, Installation Instructions, and Warrantees.

#### 1.04 QUALITY ASSURANCE

- A. Supplier:
  - 1. Door hardware shall be supplied by a recognized finish hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than five (5) years.
  - 2. Factory direct, authorized, and stocking distributor of the Exit Devices, Locksets and Door Closers.
  - 3. Employ an Architectural Hardware Consultant, certified by the Door and Hardware Institute.
- B. Source: Obtain each kind of Hardware (Butts, Locksets, Exit Devices, Door Closers, etc.) from only one manufacturer.
- C. Installer: Finish hardware shall be installed only by experienced tradesmen in compliance with trade union jurisdictions, either at the door and frame fabrication plant or at the project site.
- D. Templates: Furnish hardware templates for each fabricator of doors, frames and other work to be factory prepared for the installation of hardware. Upon request, check the shop drawings of such other work to confirm that provisions will be made for the proper installation of hardware.

- E. Regulatory Requirements:
1. Comply with applicable local and state current building codes.
  2. Hardware for fire-rated openings shall also be in compliance with fire building codes applicable to the district in which the building is located. Provide only hardware which has been tested and listed by "UL" for the types and sizes of doors required, and which complies with the requirements of the door and door frame labels. Provide Door Closers, Automatic self latching bolts, coordinators, gasketing, and astragals if required to conform to label requirements.
  3. Comply with the requirements of ADAAG-1992, and ICC/ANSI A117.1 Accessible and Usable Building and Facilities.

## 1.05 PRODUCT HANDLING AND STORAGE

- A. Packaging: Each item or package is to be separately tagged with identification related to the final hardware schedule. Complete installation instructions shall be included in the packages.
- B. Storage: Provide a locked room at the jobsite for the storage of the hardware.

## 1.06 WARRANTY

- A. The following products shall be warranted for periods beyond two years:
1. Locksets – Three Years.
  2. Door Closers - Thirty Years.
  3. Panic Devices - Three Years.

## 1.07 MAINTENANCE

- A. Furnish the following extra materials, which shall be delivered directly to the Project Representative prior to substantial completion.
1. Two sets of special tools required for installation and adjustment
  2. Extra Hardware:

Quantity	Description	Factory Number
Two	Locksets	L9070
Two	Door Closers	4040XP-EDA

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Manufacturers: Products may be furnished by the manufacturers listed under "As Specified" below, or equivalent products of type, grade, design, and function from manufacturers listed under "Acceptable Substitutions".

Product	As Specified	Acceptable Substitutions
Butt Hinges	McKinney (MC)	Bommer, Hager, Ives
Continuous Gear Hinges	Pemko (PE)	ABH, Roton, Select
Continuous Pin Hinges	Markar (MA)	ABH, Ives
Locksets and Latchsets	Schlage (SC)	Corbin, Sargent
Keying and Cylinders	Best (BE)	None
Narrow Stile Deadlatches	Adams Rite (AR)	None
Narrow Stile Locksets	Accurate (AC)	None
Occupancy Indicators	Tice (TI)	None
Exit Devices	Von Duprin (VO)	Corbin, Sargent
Weatherized Exit Devices	Detex (DE)	None
Door Closers	LCN (LCN)	Norton 7500 Series,

Product	As Specified	Acceptable Substitutions
		Sargent 281 Series
Door Pulls	Trimco (TR)	Ives, Tice, Rockwood
Push and Pull Plates	Trimco (TR)	Ives, Tice, Rockwood
Kick & Mop Plates	Tice (TI)	Ives, Rockwood, Trimco
Wall and Floor Stops	Trimco (TR)	Ives, Rockwood
Overhead Stop and Holders	Glynn-Johnson (GJ)	ABH, Rixson
Weatherstrip	Pemko (PE)	National Guard, Reese
Thresholds	Pemko (PE)	National Guard, Reese

## 2.02 HARDWARE MATERIALS AND FABRICATIONS

- A. Fasteners: Provide fasteners for installation with each hardware item. Provide Phillips head fasteners, countersunk oval, flat head, or undercut head as appropriate for material to be installed. Provide Door Closers and Exit Devices applied to Wood Composite or Mineral Core Doors with Sex Bolts sized to the Thickness of the Door.
- B. Compatibility: Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fastener.

## 2.03 HARDWARE FINISHES

- A. Finish: Finish in general shall be: US26D, Satin Chrome Plated (BHMA 626), except:
  - 1. Locksets and Latchsets: US32D, Satin Stainless Steel (BHMA 630).
  - 2. Push and Plates and Door Pulls: US32D, Satin Stainless Steel (BHMA 630).
  - 3. Continuous Gear Hinges: Clear Anodized Aluminum.
  - 4. Interior Hinges: US26D, Satin Chrome over Steel Base (BHMA 652).
  - 5. Exterior Hinges: US32D, Satin Stainless Steel (BHMA 630).
  - 6. Exit Devices:
    - a. 35 Series: US26D Satin Chrome Plated (BHMA 626).
    - b. Weatherized: US32D, Satin Stainless Steel (BHMA 630).
  - 7. Door Closers: Painted Aluminum (BHMA 689).
  - 8. Kick Plates: US32D, Satin Stainless Steel (BHMA 630).
  - 9. Overhead Stops: US32D, Satin Stainless Steel (BHMA 630).
  - 10. Smoke Gasketing: as selected.
  - 11. Threshold, Weatherstrip & Door Bottoms: as listed.

## 2.04 BUTTS, CONTINUOUS GEAR, CONTINUOUS PIN HINGES

- A. Quantity (per Leaf):
  - 1. Door openings up to 60": 2 each.
  - 2. Door openings 60 to 90": 3 each.
  - 3. Doors over 90": Furnish one additional for each 30" increment or fraction thereof.
- B. Sizes:
  - 1. 1-3/4" Exterior & Vestibule Doors: 5 x 4-1/2".
  - 2. 1-3/4" Interior Doors up to and including 36": 4-1/2 x 4-1/2".
  - 3. 1-3/4" Interior Doors over 36": 5 x 4-1/2".
- C. Width of Hinges shall be as required to clear projecting trim or other conditions to allow maximum degree of opening.
- D. Hinges shall have non-removable pins (NRP - Set Screw in Barrel).
- E. Hinges shall have flat button tips.

- F. For unusual size or weight doors, furnish type, size and quantity recommended by the hinge manufacturer.
- G. Coordinate Continuous Gear Hinge type (Flush, Inset, or Kawneer) with Aluminum Door and Frame supplier.

## **2.05 LOCKSETS AND CYLINDERS**

- A. Furnish Lever Handle Locksets and Latches in 17L Design.
- B. Backset: 2-3/4".
- C. The Locksets and Latchsets shall be listed with Underwriters Laboratories for A label and lesser class doors.
- D. Cylinders:
  - 1. Provide small format Key Removable Interchangeable Cores.
  - 2. Provide appropriate cylinder type, length, collars, and cam type to operate specified Locksets and Exit Devices.
- E. Provide Curved Lip Strikes with adequate projection to protect door trim. Provide flat, flush lip strikes for pairs of doors with overlapping Astragals.
- F. Provide manufacturers standard wrought or plastic strike boxes.

## **2.06 PANIC DEVICES AND FIRE EXIT HARDWARE**

- A. Size Exit Devices in accordance with the manufacturer recommendations.
- B. Provide U.L. Listed Fire Exit Hardware at rated openings.
- C. Lever Trim: Exit Device Lever Trim shall match design specified under 2.05.A.
- D. Provide Glass Bead Kits where interference with Door vision frames occurs.

## **2.07 DOOR CLOSERS**

- A. Drop Plates: Furnish drop plates where doors have insufficient height top rails, or where Regular Arm Door Closers are used in conjunction with Concealed Overhead Stops.
- B. Provide special closer mounting as required where interference with weatherstrip or sound seals occurs.
- C. Furnish cold weather fluid, at exterior & vestibule doors. Furnish non-flammable fluid at fire rated openings in conformance with UL Test Standard 10C.
- D. Furnish Spacer Blocks and/or shoe supports where frame stop does not provide for adequate support for the parallel arm soffit shoe.
- E. Furnish Fifth Hole Spacers or Shoe Supports where required by Frame configuration.

## **2.08 KICK, MOP, AND PLATES**

- A. Kick and Armor Plates shall be applied to the Push Side of the Door, Mop Plate applied to the Pull Side.

- B. Plates shall be beveled four edges (B4E) and countersunk for screws.
- C. Height: Kick Plates, 10 IN, Mop Plates 10 IN, Armor Plates 34 IN.
- D. Plates shall be furnished with width as required to provide 1/4 IN clearance at sides of doors, stops, sound seal, or weatherstrip.

## **2.09 STOPS AND HOLDERS**

- A. Furnish Overhead Stop and Holders sized as recommended by the manufacturer.
- B. Furnish Overhead Stop and Holders with special shims, brackets, or special template mounting where required.
- C. Where wall stops are not applicable, furnish floor stops 1215CKU Series, or Overhead Stops if required.

## **2.10 THRESHOLDS**

- A. Fasteners: Furnish Thresholds with ¼ IN - 20 x 2 IN Flat Head Sleeve Anchors.

## **2.11 WEATHERSTRIP AND GASKETING**

- A. Furnish weatherstrip and gaskets for complete perimeter of opening, including mullions, and astragals. Furnish weatherstrip at sill of Four (4) sided frames.

## **2.12 DOOR SILENCERS**

- A. Furnish Rubber Door Silencers for openings not specified to have Smoke Gasketing or Weatherstrip.
- B. Quantity: Furnish three (3) for each single door frame, and four (4) for each pair of door frames.
- C. Type: 1229A.

## **2.13 MISCELLANEOUS HARDWARE REQUIREMENTS**

- A. Not Used.

## **2.14 KEYING**

- A. All keyed operated components (Locksets, Cylinders, Deadlocks, etc.) specified in this Section shall be keyed to the existing Best Grand Master Key system.
- B. Provide Brass construction Cylinder and Keys during the construction period. Plastic Construction Cylinders are unacceptable.
- C. Key Conference: The Door Hardware Supplier shall meet with the Owner to prepare the permanent keying schedule. Submit Key Schedule for Approval in accordance with 1.04 F.
- D. All permanent change keys, and master keys, prepared according to the approved keying schedule, shall be transmitted directly to the Owner, prior to substantial completion. The General Contractor shall replace interchangeable cores with the permanent cores under the supervision of the Owner's authorized representative. Demonstrate proper keying and lock operation. All temporary cores shall be returned by the Contractor to the Door Hardware Supplier.



- E. All Permanent Cylinders and Keys shall be sent direct from the lock manufacturer via Registered Mail, Return Receipt Requested.
- F. Provide a key transcript list of all cylinders, including 25% additional change combinations.
- G. Stamping: Stamp all keys and with system number and sub number designations as directed.
- H. Furnish:
1. Six (6) Building Grand Master Keys.
  2. Six (6) Master Keys per Set.
  3. Four (4) change keys per Lockset or Cylinder.
  4. Six (6) Construction Keys.
  5. Two (2) Construction Control Keys.
  6. Two (2) Permanent Control Keys.

## 2.15 HARDWARE GROUPS

### HW-1

#### Door #200.101A

1	Continuous Hinge	MA	HG-305
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Door Closer	LCN	4040XP Spring-CUSH x ST1595
1	Kick Plate	TI	B4EKP
1	Threshold	PE	256x6A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN

### HW-2

#### Door #300.101A

2	Continuous Hinges	MA	HG-305
1	Entrance Lockset	SC	L9060L
2	Mortise Cylinders	BE	1E74
1	Flush Bolt (Top)	TR	3917 – 24"
1	Flush Bolt (Bottom)	TR	3917 – 12"
1	Dust Proof Strike	TR	3911
1	Door Closer (Active Leaf)	LCN	4040XP Spring-H-CUSH x ST1595
1	Overhead Stop & Holder	GJ	90H Series
2	Kick Plates	TI	B4EKP
1	Threshold	PE	171A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
2	Door Sweeps	PE	315CN
1	Astragal	PE	357SP x S88D x TB

**HW-3**

Doors #300.101C, 300.102A, 300.104B, 900.114A

4	Each Hinges	MC	T4A3386
1	Entrance Lockset	SC	L9060L
2	Mortise Cylinders	BE	1E74
1	Lock Astragal	TR	5000T
1	Door Closer	LCN	4040XP Spring-H-CUSH x ST1595
1	Kick Plate	TI	B4EKP
1	Threshold	PE	171A
1	Threshold	PE	256x6A (Door #900.14A)
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN

**HW-4**

Doors #300.101D, 300.104A, 400.103A, 500.101A, 500.101C, 900.114B

All Hardware by Door Manufacturer

**HW-5**

Doors #300.103A, 900.150B

4	Each Hinges	MC	T4A3386
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Door Closer	LCN	4040XP Spring-CUSH x ST1595
1	Kick Plate	TI	B4EKP
1	Threshold	PE	176A
1	Threshold	PE	256x6A (Door #900.150B)
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN

**HW-6**

Door #300.104C

3	Each Hinges	MC	TA2714
1	Exit Device	VO	98L-F x 996L-NL
1	Rim Cylinder	BE	1E72
1	Door Closer	LCN	4040XP Spring-CUSH
1	Kick Plate	TI	B4EKP
1	Set Gasket	PE	S88D

**HW-7**

Doors #400.101A, 400.101S, 400.104A, 400.104B, 500.100S

1	Continuous Pin Hinge	MA	FM-300
1	Weatherized Exit Device	DE	40xW-03CN-HD-99S
1	Rim Cylinder	BE	1E72
1	Door Pull	TR	1195-1
1	Door Closer	LCN	4040XP Spring-CUSH x SRI Prime
1	Gate Plate Kit	DE	GTPLKIT

<b>HW-8</b>			
Doors #400.102A, 500.101B, 500.101D			
3	Each Hinges	MC	T4A3386
1	Entrance Lockset	SC	L9060L
2	Mortise Cylinders	BE	1E74
1	Lock Astragal	TR	5000T
1	Door Closer	LCN	4040XP Spring-H-CUSH x ST1595
1	Kick Plate	TI	B4EKP
1	Threshold	PE	171A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN

<b>HW-9</b>			
Door #400.105A			
3	Each Hinges	MC	T4A3386
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Door Closer	LCN	4040XP Spring-CUSH x ST1595
1	Kick Plate	TI	B4EKP
1	Threshold	PE	176A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN

<b>HW-10</b>			
Doors #800.101A, 800.102A, 900.150A			
8	Each Hinges	MC	T4A3386
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Exit Device	VO	LD98EO
1	Removable Mullion	KR	KR4954
1	Mortise Cylinder	BE	1E74
2	Door Closers	LCN	4040XP Spring-H-CUSH x ST1595
2	Kick Plates	TI	B4EKP
1	Threshold	PE	256x6A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN
2	Mullion Weatherstrip	PE	319CN

<b>HW-11</b>			
Doors #800.101B, 800.102C, Reference Civil Plans for locations			
1	Continuous Pin Hinge	MA	FM-300
1	Weatherized Exit Device	DE	40xW-03CN-HD-99
1	Rim Cylinder	BE	1E72
1	Door Pull	TR	1195-1
1	Wall Stop	TR	1270CX
1	Gate Plate Kit	DE	GTPLKIT

HW-12			
Door #900.100A			
1	Continuous Gear Hinge		CFM__SLIHD1 to CFM__SLFHD1
1	Exit Device		35A-NL-OP
1	Rim Cylinder		1E72
1	Door Pull		1191-4 x Type N Fasteners
1	Door Closer		4040XP-EDA
1	Drop Plate		4040-18PA-EDA
1	Overhead Stop		100ADJ-S Series
1	Threshold		256x6A
1	Door Shoe		210AV
	Head and Jamb Weatherstrip		By Frame Manufacturer

HW-13			
Door #900.100S			
1	Continuous Pin Hinge	MA	FM-300
1	Classroom Lockset	SC	L9070L
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP Spring-CUSH x SRI Prime

HW-14			
Doors #900.101, 900.102			
3	Each Hinges	MC	TA2714
1	Privacy Lock	SC	L9040 x 17B
1	Occupancy Indicator	TI	Type C
1	Door Closer	LCN	4040XP Spring-CUSH
1	Kick Plate	TI	B4EKP
3	Silencers		

HW-15			
Door #900.114D			
3	Each Hinges	MC	TA2714
1	Classroom Lockset	SC	L9070L
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP Spring-CUSH
1	Kick Plate	TI	B4EKP
1	Set Gasket	PE	S88D

HW-16			
Door #900.103A			
1	Continuous Gear Hinge	PE	CFM__SLIHD1 to CFM__SLFHD1
1	Exit Device	VO	35A-NL-OP
1	Rim Cylinder	BE	1E72
1	Door Pull	TR	1191-4 x Type N Fasteners
1	Door Closer	LCN	4040XP-EDA
1	Drop Plate	LCN	4040-18PA-EDA
1	Wall Stop	TR	1298
1	Threshold	PE	256x6A
1	Door Shoe	PE	210AV
	Head and Jamb Weatherstrip		By Frame Manufacturer

HW-17			
Door #900.105A			
6	Each Hinges	MC	TA2714
1	Classroom Lockset	SC	L9070L
1	Mortise Cylinder	BE	1E74
2	Flush Bolts	TR	3917 – 12"
1	Dust Proof Strike	TR	3911
1	Overhead Stop	GJ	90S Series
1	Wall Stop	TR	1270CX
1	Astragal	PE	357SS x S88D
4	Silencers		

HW-18			
Doors #900.106A			
1	Continuous Hinge	PE	CFM__SLIHD1 to CFM__SLFHD1
1	Narrow Stile Lockset	AC	8824
1	Set Lever Handles	SC	17A
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP-RA
1	Drop Plate	LCN	4040-18
1	Wall Stop	TR	1270CX

HW-19			
Door #900.106B			
3	Each Hinges	MC	TA2714
1	Latchset	SC	L9010
1	Door Closer	LCN	4040XP Spring-CUSH
1	Kick Plate	TI	B4EKP
1	Set Gasket	PE	S88D

HW-20			
Door #900.108A			
1	Continuous Gear Hinge	PE	CFM__SLIHD1 to CFM__SLFHD1
1	Deadlatch	AR	4512 x 4569
1	Mortise Cylinder	BE	1E74
1	Set Push/Pulls	TR	1738 x Type L & N Fasteners
1	Door Closer	LCN	4040XP-EDA
1	Drop Plate	LCN	4040-18PA-EDA
1	Overhead Stop	GJ	100S Series
1	Threshold	PE	276x6A
1	Door Shoe	PE	210AV
	Head and Jamb Weatherstrip		By Frame Manufacturer

HW-21			
Door #900.108B			
3	Each Hinges	MC	TA2714
1	Classroom Lockset	SC	L9070L
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP-EDA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX
1	Set Gasket	PE	S88D

HW-22			
Door #900.110A			
3	Each Hinges	MC	TA2714
1	Privacy Lock	SC	L9040 x 17B
1	Occupancy Indicator	TI	Type C
1	Door Closer	LCN	4040XP-EDA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX
3	Silencers		

HW-23			
Doors #900.111A, 900.112A			
3	Each Hinges	MC	TA2714
1	Storeroom Lockset	SC	L9080L
1	Mortise Cylinder	BE	1E74
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX
3	Silencers		

HW-24			
Door #900.113C			
3	Each Hinges	MC	TA2714
1	Privacy Lock	SC	L9040 x 17B
1	Occupancy Indicator	TI	Type C
1	Door Closer	LCN	4040XP-RA
1	Kick Plate	TI	B4EKP
1	Mop Plate	TI	B4EMP
1	Wall Stop	TR	1298
3	Silencers		

HW-25			
Door #900.114C			
3	Each Hinges	MC	TA2714
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Door Closer	LCN	4040XP-EDA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX
3	Silencers		

HW-26			
Door #900.115A			
8	Each Hinges	MC	TA2714
1	Classroom Lockset	SC	L9070L
1	Mortise Cylinder	BE	1E74
1	Flush Bolt (Top)	TR	3917 – 24"
1	Flush Bolt (Bottom)	TR	3917 – 12"
1	Dust Proof Strike	TR	3911
2	Overhead Stops	GJ	90S Series
2	Armor Plates	TI	B4EAP
1	Astragal	PE	357SS x S88D
4	Silencers		

HW-27			
Doors #900.116A, 900.116B			
2	Continuous Pin Hinge	MA	HG-305
1	Exit Device	VO	LD98L x 996L-NL
1	Rim Cylinder	BE	1E72
1	Exit Device	VO	LD98EO
1	Removable Mullion	KR	KR4954
1	Mortise Cylinder	BE	1E74
2	Door Closers	LCN	4040XP Spring-H-CUSH x ST1595
2	Kick Plates	TI	B4EKP
1	Threshold	PE	256x6A
1	Set Weatherstrip	PE	2891AS (Head) x 290AS (Jambs)
1	Door Sweep	PE	315CN
2	Mullion Weatherstrip	PE	319CN

HW-28			
Door #900.120A			
3	Each Hinges	MC	TA2714
1	Storeroom Lockset	SC	L9080L
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP Spring-CUSH
1	Kick Plate	TI	B4EKP
1	Set Gasket	PE	S88D

HW-29			
Doors #900.150C, 900.150D			
	Cam Lift Hinges		By Acoustical Door Manufacturer
1	Latchset	SC	L9010
1	Door Closer	LCN	4040XP-RA
1	Kick Plate	TI	B4EKP
1	Floor Stop	TR	215CKU
	Sound Seal		By Acoustical Door Manufacturer
	Door Bottom		By Acoustical Door Manufacturer

HW-30			
Door #900.201A			
3	Each Hinges	MC	TA2714
1	Storeroom Lockset	SC	L9080L
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4040XP-EDA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX
1	Set Gasket	PE	S88D

HW-31			
Doors #500.201A, 500.201B			
2	Track	RW	31
2	Hangers	RW	3110.00001
1	Door Latch	RW	1025
1	Door Pull	TR	1102S

**HW-32**

Site Egress Gates. Reference Civil Plans for quantities and locations

1	Continuous Pin Hinge	MA	FM-300
1	Weatherized Exit Device	DE	40xW
1	Gate Plate Kit	DE	GTPLKIT

**PART 3 EXECUTION****3.01 PREPARATION**

- A. Examination: Examine Doors, Frames, and related items for conditions that would prevent the proper application and operation of the Doors and Door Hardware. Do not proceed until defects are corrected.
- B. Provide solid blocking for wall mounted components.
- C. Fasteners: Check conditions and use fastening devices as needed to securely anchor the hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable.

**3.02 INSTALLATION**

- A. Mounting Heights: Mount units at heights as recommended in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames (2001)" by Doors and Hardware Institute, except as indicated below. Products not specifically covered shall be installed in accordance with the manufacturer templates and instructions.
  - 1. Hinges:
    - a. Top Hinge: 7-1/4", Top of frame rabbet to centerline of hinge.
    - b. Bottom Hinge: 12-1/4", Bottom of Frame to centerline of hinge.
    - c. Intermediate Hinges: Centered, equal spacing between top and bottom hinges.
  - 2. Mortise Lock Strikes: 40", bottom of frame to centerline of Strike.
  - 3. Wall Stops: Locate Wall Stops intended for use with Lever Handle Locksets and Exit Devices at the Centerline of the Spindle or Pull.
  - 4. Deadlocks: 48", bottom of frame to centerline of Cylinder.
  - 5. Push and Pull Plates: 42", bottom of frame to centerline of Plate.
- B. Install each hardware item in compliance with manufacturer's instructions.
  - 1. Cutting and Fitting: Wherever cutting and fitting are required to install hardware surfaces which will be painted or finished at a later time, install each item completely and then remove and store in a secure place. After completion of the finishes, re-install each item.
  - 2. Finishes: Do not install surface-mounted items until finishes have been completed on the substrate.
  - 3. Install Fire Rated Openings to comply with NFPA 80.
  - 4. Trim Exit Devices to provide 1-1/2 IN clearance between End Cap and hinge jamb stop face and/or stop applied weatherstrip.
  - 5. Door Closers shall be located to allow maximum degree of opening that project conditions will allow. Door Closers shall not be used to stop the door, except for models equipped with an integral stop-on-the-arm feature.
  - 6. Overhead Stops: Furnish Overhead Stop and Holders with maximum degree of opening that project conditions will allow.
  - 7. Floor Stops: Locate Floors Stops at maximum degree of opening that project conditions will allow. Do not locate Floor Stops where they create a hazardous condition. Stops should be located no more than 1/3 Door width from the latch edge of the Door.
  - 8. Thresholds: Set Thresholds in a bed of butyl rubber sealant in conformance with Division 7 requirements. Remove excess sealant. Caulk edges and joints to exclude moisture.



9. Sound Seal: Sound Seals for vertical jambs shall be installed full length of jamb. Do not notch or shorten the Sound Seal to clear surface mounted Automatic Door Bottoms.
  10. Weatherstrip: Mount and adjust Rigid Jamb Weatherstrip prior to mounting Parallel Arm Door Closers. Weatherstrip shall be installed to provide a continuous seal at head and jambs. Do not notch Weatherstrip for Door Closer shoe. Provide Parallel Arm 5th hole spacer of increased thickness to allow for revised location.
  11. Astragals: Mount Astragals on the pull side of active leaf for out-swinging applications, inactive leaf for in-swinging.
  12. Smoke Gasket:
    - a. Completely clean frame and apply gasket in accordance with manufacturer's instructions.
    - b. Apply Gasket to Door rabbet of hinge jamb and to stop face of Strike Jamb and Headers, as described in Pemko's installation instructions for alternative positioning.
- C. Adjust and check each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

### **3.03 ADJUSTMENT**

- A. Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of hardware during the week prior to acceptance or occupancy. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers to comply with following ICC/ANSI A117.1 requirements.
  1. Closing Speed: Door Closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to an open position of 12 degrees shall be 5 seconds minimum.
  2. Opening Force: The maximum force for pushing or pulling a door open shall be as follows: (these forces do not apply to the force required to retract latch bolts or disengage other devices securing the door).
    - a. Fire Doors: The minimum opening force allowable by the appropriate administrative authority.
    - b. Exterior Doors: 10 lbf (44.4 N).
    - c. Interior Doors: 5.0 lbf (22.2 N).
  3. Adjust backcheck to prevent damage to the closer, hardware, door and frame, and wall.
- C. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes.

### **3.04 COMPLETION**

- A. Provide three copies of an as-built hardware schedule, including keying, when all hardware installation is complete.
- B. Provide two sets of any special tools required for installation and maintenance of hardware.

### **END OF SECTION**

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## SECTION 08800

### GLAZING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
1. Glass and glazing for aluminum entrances, storefronts, and curtain wall.
  2. Glass for hollow steel doors.
  3. Glazing schedule at the end of the Section.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI Z97.1	American National Standard: Performance Specifications and Test Methods for Safety Glazing Materials in Buildings.
ASTM C1036	Standard Specification for Flat Glass.
ASTM C1048	Standard Specification for Heat Treated Flat Glass, Kind HS, Kind FT (Coated and Uncoated).
ASTM C 1184	Standard Specification for Structural Glazing Sealant.
ASTM E2188	Standard Test Method for Insulating Glass Unit Performance.
ASTM E2197	Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation.
IANA	Glass Association of North America: Glazing Manual.
NFPA 80	National Fire Protection Association: Standard for Fire Doors and Windows; currently enforced edition.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Submittals specified in this Section shall be incorporated into submittals specified in other Sections, where glass is to be provided in those Sections.
- C. Product Data: Submit product data on glass, glazing materials, and insulating glass system.
- D. Shop drawings: Show size and thicknesses of glass, proposed "bites" in frames, sizes and locations of blocking, spacers, beads, stops, and edge treatments. Note quality, type, and strength of each light.
- E. Samples: Submit 12 x 12 inch samples of each type of glass.
- F. Quality Control Submittals:
1. Certifications:
    - a. Submit written certification that glazing has been designed in conformance with the specified glass stress analysis to meet the structural criteria specified.
  2. In most jobs probably the certification above is sufficient rather than the documentation below.

3. Glass Stress Analysis Documentation:
  - a. Submit written and graphic analysis demonstrating compliance with requirements as follows.
    - 1) Indicate the design criteria for each worse case glazing condition.
    - 2) Indicate calculations verifying conformance to thermal and structural criteria for each worse case glazing condition.
    - 3) For each separate worse case glazing condition, indicate glass thickness, type, and whether glass is annealed, heat-strengthened, or tempered.

#### **1.04 GLASS PERFORMANCE CRITERIA**

- A. Glass Stress Analysis:
  1. Perform stress analysis to determine the proper glass thickness and treatment required to resist the structural and thermal stresses for each glazing condition (based on the worse case for each condition). Bidder can't bid the first version because the stress analysis isn't done until after the bids are received.
  2. Should the stress analysis show that glass of greater strength or thickness is required over that scheduled, then such changes shall be incorporated into the Work. Changes shall be in accordance with unit pricing. Include unit prices for heat strengthening, tempering, and different glass thicknesses on a per square foot basis.
  3. Stress analysis shall conform to the requirements of ASTM E1300.
- B. Thermal Stress Criteria:
  1. Assume that warm or cold air from HVAC ceiling registers (located on room side of blinds) will be directed toward window.
  2. Assume that light colored "mini-blinds" will be installed. Do not assume the space between the window and blinds will be ventilated.
- C. Structural Stress Criteria:
  1. Vertical Glazing: Design glazing to withstand positive and negative wind loads as indicated in the Structural Drawings and in accordance with SBC requirements.
  2. Skylight Glazing:
    - a. Design glazing to withstand a 200 lb concentrated downward load at midspan, without breakage and with a safety factor of 4.
    - b. Design glazing to withstand live loads and positive and negative wind loads as indicated in the Structural Drawings and in accordance with SBC requirements.
  3. Design for a glass breakage based on statistical glass breakage factor of 8 lights per 1,000. Breakage of either light in an insulating glass unit shall constitute unit breakage.
  4. Center Deflection: Maximum deflection shall not exceed  $L/175$  or  $3/4$  inch, whichever is less.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with applicable provisions of this Section.
- B. Provide cushions at edges of glass to prevent impact damage during shipment and storage.
- C. Keep vacuum cups free from foreign material that could scratch glass.
- D. Comply with insulating unit fabricators requirements for limits on exposure to reduced barometric pressure during shipment.

## **PART 2 PRODUCTS**

### **2.01 GLASS**

- A. Furnish the following glass in combinations as scheduled at the end of this Section:
  - 1. Clear Glass: ASTM C1036, Type I, class 1 (clear), quality Q3 glazing select.

### **2.02 ACCESSORIES**

- A. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness; 4 inches long x 1/4 high x width as required for application indicated.
- B. Weather Glazing Sealant: Compatible with insulating glass seal.
- C. Structural Glazing Sealant: Conforms to ASTM C1184; silicone glazing sealant as recommended by the manufacturer for the application; black color. Products of one of the following manufacturers:
  - 1. Dow Corning.
  - 2. General Electric by Momentive Performance Materials Inc.
  - 3. Sika.
- D. Structural Glazing Tape: VHB Structural Glazing Tape by 3M.
- E. Glazing Tape (Interior): Norton "V-980," PTI "303," or Approved Equal. Size: 1/8 inch by 1/2 inch.

### **2.03 FABRICATION**

- A. Insulating Glass Units:
  - 1. Dual lite units fabricated from glass as scheduled; 1/2 inch nominal airspace; dual seal system.
  - 2. Twin seals; polyisobutylene primary seal and silicone secondary seal. Outer seal shall be compatible with glazing system.
  - 3. Spacer Bar: Thermally improved spacer; one of the following:
    - a. TGI-Spacer by Technoform.
    - b. Superspacer by Quantex Building Products.
    - c. Stainless steel.
    - d. Fill with desiccant; corners shall be partially miter cut and bent (not cut through), or formed with corner keys ultrasonically soldered in place.
    - e. Approved Equal.
  - 4. Newer technology: Azon (Warm-Light, thermally broken aluminum) and Technoform (TGI Spacer - stainless steel) also for thermal edge EdgeTech, require the "Super Spacer Tri-Seal."
  - 5. Certified through the Insulating Glass Certification Council (IGCC) in accordance with ASTM E2188, E2189, and E2190; certified to level CBA.
  - 6. Each piece shall bear certification number, date, and manufacturer's identification mark.
  - 7. Assembly of insulating units shall be by a fabricator approved by the glass materials manufacturer.
- B. Tempered and Heat Strengthened Glass:
  - 1. Tempered Glass: Fully tempered in accordance with ASTM C1048; certified safety glass in accordance with ANSI Z97.1.
  - 2. Heat Strengthened Glass: ASTM C1048, HS; glass which has been heat treated to strengthen glass in bending to not less than 2 times annealed strength.
  - 3. Fabricate tempered and heat strengthened glass units so that principle roll wave and quench pattern distortion will be in the vertical direction in the finished installation.
  - 4. Comply with code requirements for identification and labeling of safety-glazing materials in hazardous locations subject to human impact loads.

- C. Laminated Glass (PVB):
  - 1. Two layers of glass as scheduled with a minimum .030 inch combined thickness vinyl interlayer. Use .060 thick vinyl interlayer at skylight conditions with heat treated glass.
  - 2. Film:
    - a. Basis of Design Manufacturer: Saflex Architectural by Solutia, Inc. a Division of Eastman Chemical or Approved Equal.
    - b. Type: Polyvinyl butyral sheets, uniform in color, specifically manufactured for use in fabrication of laminated glass sheets, ultraviolet stabilized, uniform thickness as specified.
    - c. Translucent Laminating Film: Match Vanceva 0009 "Arctic Snow." minimum 0.030 inch thickness.
- D. Low E Coating:
  - 1. High performance type; applied by using sputtered deposition technology.
  - 2. Acceptable Products:
    - a. PPG "Solarban 70XL.
    - b. Guardian SNX 62/27.
    - c. Viracon VNE 1-63.
    - d. Approved Equal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.
- C. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.

### **3.02 PREPARATION**

- A. Clean contact surfaces and wipe dry.
- B. Seal frame corner joints, and other leakage points with sealant. At insulating glass units the sealant shall be compatible with the seal of the unit. Do not plug weep holes.
- C. Prime surfaces scheduled to receive sealant, unless otherwise recommended by the sealant manufacturer.

### **3.03 INSTALLATION**

- A. Setting Blocks: Place setting blocks in frames for support of glass. Place at quarter points unless approved otherwise.
- B. Set glass tightly in position with proper clearances in accordance with the referenced standards.

- C. Perimeter glass clearances within setting frame shall be in accordance with GANA recommendations, and as required by the glass manufacturer to provide for wind, earthquake drift, and thermal expansion.
- D. Unless specified otherwise, glaze units with gaskets furnished with the framing systems specified in other Sections.
- E. Structural Glazing:
  - 1. Structural glazing shall be in accordance with the structural glazing system manufacturer's written recommendations, and the approved aluminum framed glazing system shop drawings.
  - 2. Unless specified otherwise, provide structural glazing sealant or tape systems at the Contractor' option.
- F. Glazing for Interior Non-Rated Doors and Windows, Where Gaskets Are Not Furnished:
  - 1. Glaze with glazing tape.
  - 2. Pre-measure and cut tapes to required lengths; adhere to fixed stops, setting horizontal tape at heads and sills before vertical tape.
  - 3. Install tape with tight butt joints; no overlaps will be accepted. Set tape with straight lines level with frame sight line.
  - 4. Position glass, uniformly sealing against tape. Install inside removable stops and place tape in stops forming a uniform seal against glass, level with sight lines.
- G. Adjust glazing materials to form a uniform sight line.

### **3.04 CLEANING**

- A. Clean excess glazing materials from adjacent finished surfaces.
- B. Remove labels after work is completed.

### **3.05 GLASS TYPE SCHEDULE**

- A. The following are the glass types as indicated in the Drawings:
  - 1. GL-1:
    - a. Insulating glass unit with 1/2 inch space between two panes of glass as follows:
      - 1) Exterior Pane: 1/4 inch clear glass with low e coating on #2 surface.
      - 2) Argon fill.
      - 3) Interior Pane: 1/4 inch clear glass.
    - b. Performance as follows:
      - 1) Visible Light Transmittance: Minimum 68%.
      - 2) Winter U value: .24.
      - 3) Shading Coefficient: Minimum .43.
      - 4) SHGC: Minimum .37.
  - 2. GL-2: GL-1 unit with translucent laminated inner lite.
  - 3. GL-3: Minimum 1/4 inch thick clear glass.
- B. Except where laminated glass is specifically scheduled, provide tempered glass in hazardous locations indicated to meet the requirements of the jurisdictional code authorities for safety glazing (SG).
- C. Provide tempered or heat strengthened panes to meet specified stress analysis requirements.

### GLASS LOCATION SCHEDULE

Type	Location
GL-1	Exterior glazing unless scheduled otherwise.
GL-2	Exterior glazing where scheduled.
GL-3	Interior glazing, unless scheduled otherwise.

END OF SECTION



## DIVISION 09

### FINISHES

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## SECTION 09260

### GYPSUM BOARD SYSTEMS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes metal stud wall framing, metal channel ceiling framing, acoustical insulation, gypsum board, gypsum sheathing, cementitious backer board and taped and sanded joint treatment.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C36	Specification for Gypsum Wallboard
ASTM C79	Specification for Treated Core and Nontreated Core Gypsum Sheathing
ASTM C645	Specification for Non Structural Steel Framing Members
ASTM C754	Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
GA-201	Gypsum Board for Walls and Ceilings
GA-216	Recommended Specifications for the Application and Finishing of Gypsum Board
SBC	Seattle Building Code

- B. Perform work in accordance with the Gypsum Association Specification Ga-201, GA-216 and ASTM C754.

##### 1.03 SUBMITTALS (NOT USED)

##### 1.04 SITE CONDITIONS

- A. During cold weather, in areas receiving gypsum board installation, maintain temperature range between 55 to 70 degrees F for 24 hours before, during and after gypsum board and joint treatment application.
- B. Provide ventilation during and following adhesives and joint treatment application.
1. Use temporary air circulators in enclosed areas lacking normal ventilation.
  2. Allow additional drying time between coats of joint treatment under slow drying conditions.
  3. Protect installed materials from drafts during hot, dry weather.

#### PART 2 PRODUCTS

##### 2.01 METAL FRAMING MATERIALS

- A. Studs and Tracks:
1. ASTM C645.
  2. 25-gage or 20-gage, as indicated.
  3. For exterior use.
  4. In widths shown.

5. Sheet steel formed with:
  - a. A flange, 1 1/4-inch.
  - b. A knurled face.
  - c. Knock-out pass-through holes.
  - d. Galvanize to G60 or electro-galvanized.
- B. Furring Channels:
  1. ASTM C645.
  2. 25-gage.
  3. Sheet steel formed to a hat shape with:
    - a. Depth: 7/8-inch.
    - b. A knurled face.
    - c. Galvanize to G60 or electro-galvanized.

## **2.02 GYPSUM BOARD MATERIALS**

- A. Gypsum Board:
  1. ASTM C36.
  2. 5/8-inch.
  3. Ends square cut, taper-edges.
  4. Supply in 48-inch widths and in such lengths as will result in a minimum of joints.
- B. Fire Rated Gypsum Board:
  1. ASTM C36.
  2. Fire resistive type, UL-rated.
  3. 5/8-inch.
  4. Ends square cut, taper-edges.
  5. Supply in 48-inch widths and in such lengths as will result in a minimum of joints.
- C. Gypsum Sheathing Board:
  1. ASTM C79.
  2. Moisture resistant type.
  3. 1/2-inch, ends square cut, square edges.
  4. Water repellent glass mat faces.
  5. Supply in 48-inch widths and in such lengths as will result in a minimum of joints.
- D. Cementitious Backing Board:
  1. High density.
  2. Glass fiber reinforced.
  3. 1/2-inch thick.
  4. 2 inches wide.
  5. Coated glass fiber tape for joints and corners.
- E. Sustainability Requirements: Section 01350.

## **2.03 ACCESSORIES**

- A. Adhesives:
  1. GA-201 and GA-216; types recommended in writing by the manufacturer.
  2. Adhesives containing asbestos fibers are not permitted.
  3. Joint and fastener concealment:
    - a. Embedding compound for first and second coats.
    - b. Finishing compound for final coat.

- B. Fasteners:
  - 1. GA-216.
  - 2. Screws for board attachment: shouldered flathead design for use with special power-driven tools.
  - 3. Metal screws: not less than 1-inch long with self-tapping threads and self drilling points.
- C. Metal Trim:
  - 1. GA-201 and GA-216.
  - 2. Zinc-coated steel not lighter than 26-gage.
  - 3. Metal trim shall be in one of the following shapes and sizes:
    - a. Casing beads:
      - 1) Channel shaped with a concealed wing not less than 7/8-inch wide and an exposed wing.
      - 2) Exposed wing may be covered with paper cemented to metal and shall be suitable for joint treatment.
    - b. Corner beads:
      - 1) Angle-shaped with wings not less than 7/8-inch wide and perforated for nailing and joint treatment or with combination metal and paper wings bonded together.
      - 2) Not less than 1-1/4 inches wide and suitable for joint treatment.
    - c. Edge beads for use at perimeter of ceilings:
      - 1) Angle-shaped with wings not less than 3/4-inch wide.
      - 2) Concealed wing shall be perforated for screwing and exposed wing edge folded flat.
      - 3) Exposed wing may be factory finished in a white color.
- D. Resilient Channels: Unimast Inc. "RC Deluxe Resilient Channel," or an Approved Equal; 25 gage x 1/2 inch x 2-1/2 inches.
- E. Reinforcing Tape: As recommended in writing by the manufacturer of the wallboard.

## **PART 3 EXECUTION**

### **3.01 METAL STUD INSTALLATION**

- A. General:
  - 1. Install studs, furring channels, and steel ceiling channels true vertical and level.
  - 2. Install ceilings to meet SBC requirements for suspended ceiling systems in local area.
  - 3. Studs:
    - a. Unless otherwise indicated, install at 24 inches on center, in a floor and ceiling track.
    - b. Secure tracks with powder-driven pins at 24 inches on center.
- B. Furring Channels:
  - 1. Install on walls at 24 inches on center and secure to the wall at 24 inches on center.
  - 2. Unless otherwise indicated, secure furring channels for ceilings to the steel channel with 9-gage wire clips at 24 inches on center.

### **3.02 BOARD INSTALLATION**

- A. Install gypsum board in accordance with GA-201 and GA-216.
- B. Erect single layer standard gypsum board to minimize joints, with ends and edges occurring over firm bearing.
- C. Erect single layer fire rated gypsum board vertically, with ends and edges occurring over firm bearing.
- D. Erect exterior gypsum sheathing horizontally, with edges butted tight and ends occurring over firm bearing.

- E. Use screws when fastening gypsum board to metal furring or framing.
- F. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials and as indicated.
- G. Install backing board over substrate in accordance with manufacturer's instructions.
- H. Install water resistant gypsum board at wet locations.
- I. Install cementitious backer board as backing for tile work.
- J. Control joints:
  - 1. Form control joints of casing bead trim installed back-to-back over separate framing or furring members.
  - 2. Maintain a spacing of 3/16-inch between opposite beads.
  - 3. Place control joints consistent with lines of building spaces or as indicated.

### **3.03 JOINT TREATMENT**

- A. Tape, fill and sand exposed joints, edges and corners to produce smooth surface ready to receive finish.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32-inch.

### **3.04 TOLERANCES**

- A. Maximum variation of finished gypsum board surface from true flatness: 1/8-inch in 10 feet.

**END OF SECTION**

## SECTION 09300

### TILE WORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies ceramic tile, base and wall finish.

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI/TCA A137.1	American National Standard Specifications for Ceramic Tile
ANSI/TCA A136.1	American National Specifications for the Installation of Ceramic Tile
ANSI/TCA A118.3	Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive

- B. Tile Council of America Handbook for Ceramic Tile Installation.
- C. Comply with provisions of TCA Handbook for Ceramic Tile Installation.
- D. Installer: Company specializing in applying the work of this Section with documented experience.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. 12-inch square samples of materials.

##### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their original containers with seals unbroken and manufacturer's name and product identification clearly legible on each package.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

##### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain minimum temperature of 50 degrees F during installation of mortar materials.
- B. Do not install adhesives in a closed, unventilated environment.

#### PART 2 PRODUCTS

##### 2.01 TILE MATERIALS

- A. Provide end products of one manufacturer in order to achieve standardization for appearance, maintenance and replacement.

- B. Acceptable Manufacturer:
  - 1. American Olean Tile Co.
  - 2. United Tile.
  - 3. DAL Tile.
  - 4. Approved Equal.
- C. Ceramic wall tile:
  - 1. ANSI/TCA A137.1.
  - 2. TL-51
    - a. Ceramic tile.
    - b. 6 inches by 6 inches.
    - c. Cushion edges.
    - d. Match United Tile "Mosa" colored gloss glaze 20990.
  - 3. TL-52:
    - a. Ceramic tile.
    - b. 6 inches by 6 inches.
    - c. Cushion edges.
    - d. Match United Tile "Mosa" colored gloss glaze 6400".
- D. Ceramic floor tile:
  - 1. ANSI/TCA A137.1.
  - 2. TL-53:
    - a. Porcelain tile.
    - b. 6 inches by 6 inches.
    - c. Cushion edges.
    - d. Match United Tile "Mosa" colored matte glaze 75620V.
- E. Base: Match wall tile for surface finish, color and coved internal corner.
- F. Ceramic wall tile trim: Match wall tile for surface finish and color; bullnose tile at edges.

## **2.02 SETTING MATERIALS**

- A. Thinset mortar:
  - 1. ANSI/TCA A118.3, Formula 759.
  - 2. Gray.

## **2.03 GROUT MATERIALS**

- A. 100% solids epoxy grout.
- B. Resistant to shrinking.
- C. ANSI A118.4.
- D. Colors:
  - 1. GRT-51: Match Custom Building Products 115 "Platinum".
  - 2. GRT-52: Match Custom Building Products 542 "Graystone".

## **2.04 ACCESSORIES**

- A. Sealant: Per Section 07900.
- B. Sealer: Hillyard Chemical Co. - Cemseal II, Thompson's Water Seal 101.



- C. Cleaner: Neutral tile cleaner solution acceptable to tile manufacturer.
- D. Tile Accessories
  - 1. Cove wall tile transition to concrete floor (TA-51): Schluter, DILEX-AHKA, PG-Classic Grey, match with tile thickness. Use at all wall tile to concrete floor conditions.
  - 2. Cove wall tile transition to tile floor (TA-52): Schluter DILEX-HKS, PG-Classic Grey, Match with wall and floor tile thickness. Use at all wall tile to floor tile conditions.

## **2.05 GROUT MIX**

- A. Mix and proportion setting bed and grout materials in accordance with manufacturer's instructions.
- B. Color should match the existing. Submit a sample for approval.

## **2.06 CURING PAPER**

- A. Non-staining reinforced Kraft paper.

## **2.07 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION AND PREPARATION**

- A. Verify that surfaces are ready to receive work.
- B. Protect surrounding work from damage or disfiguration.
- C. Vacuum clean existing surfaces and damp clean.
- D. Correct defects or adverse conditions affecting quality and execution of tile installation.
- E. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- F. Install grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile, prior to proceeding with tile work.

## **3.02 INSTALLATION**

- A. Wall tile applied to backing board:
  - 1. Set tile in organic adhesive.
  - 2. TCA Method W223.
- B. Cut and fit tile tight to penetrations.
  - 1. Form corners and bases neatly.
  - 2. Align floor, base and wall joints.
- C. Grout tile joints. Make joints watertight without voids, cracks, excess mortar or excess grout.
- D. Apply sealant to junction of tile and dissimilar materials and at junction of dissimilar planes.

- E. Curing paper:
  - 1. Apply with perimeter and laps sealed.
  - 2. Maintain paper in perfect condition for a minimum of 5 days.

### **3.03 CLEANING**

- A. Clean with clean water promptly during progress of work so as to minimize final cleaning.
- B. Do not leave mortar scum to dry on tile faces.

**END OF SECTION**

## SECTION 09500

### ACOUSTICAL TREATMENT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies acoustical panels, spray-on absorptive treatments, and doors, with appurtenances.

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards: This Section incorporates by reference the latest revisions of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C636	Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

- B. Products:
  - 1. All equipment provided herein shall be the product of firms regularly engaged in the manufacture of this type of item.
  - 2. Each product shall be of a single manufacture.
- C. Firms:
  - 1. The application of spray-on acoustical material shall be performed by a firm certified by the material manufacturer.
  - 2. The manufacturer's representative shall be present during critical stages of the application.
  - 3. The manufacturer's representative shall ensure that all necessary measures are being taken to comply with this Section and the specifications of the manufacturer so that the finished treatment will qualify for a minimum 2-year guarantee.
- D. Inspection:
  - 1. Surfaces to receive treatment shall be inspected by the manufacturer's representative.
  - 2. The Project Representative shall be advised of any unsatisfactory condition and the Contractor shall effect any necessary corrections.
  - 3. Start of the work shall imply acceptance of the surface and responsibility for and rectify any of the resulting work found to be unsatisfactory.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. A complete description of the products and accessories in sufficient detail to demonstrate compliance with these Specifications.
- C. Spray-on acoustical materials:
  - 1. Physical properties.
  - 2. Chemical resistance.
  - 3. Quality control test data.
- D. Samples of all materials specified in this Section.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. All acoustical materials and attachment systems shall comply with pertinent local codes and regulations.
- B. Provide and install all acoustical tile and lay-in panel systems in accordance with the recommendations of ASTM C636.
- C. Install acoustical units under conditions outlined in the current bulletin of the Acoustical and Insulating Materials Association.
- D. Comply with all pertinent recommendations published by the Ceilings and Interior Systems Contractors' Association.
- E. Ceiling systems shall meet seismic requirements of the governing building code.

### **2.02 ACOUSTICAL CEILING BAFFLES (CB-51)**

- A. General:
  - 1. Acceptable manufacturer:
    - a. Filzfelt Akustika 25 Baffle.
    - b. Approved Equal.
  - 2. Colors:
    - a. FLT-1: 308 "Petrol".
    - b. FLT-2: 686 "Enzian".
    - c. FLT-3 613 "Gletxcher".
    - d. Refer to Drawings for location and quantities of color panels.
  - 3. The following rooms shall be treated with ceiling panels:
    - a. Training Room.
- B. Materials:
  - 1. Panels:
    - a. Suspended panel oriented perpendicular to ceiling.
    - b. 100% wool felt and acoustic substrate.
    - c. Thickness: 1 1/4 inches.
  - 2. All suspension hardware, anchors, clips, and other accessories used for installation of acoustical panels shall be of a nonferrous (non-rusting) material.
  - 3. Cover edges of acoustic panels with felt.
- C. Performance Requirements: noise reduction coefficient (NRC) of 1.7 or better.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Acoustical wall and ceiling panels:
  - 1. Install wall panels flush against the wall surface using Z and hat section aluminum channels anchored to the concrete wall using clips and drilled fasteners.
  - 2. For bottom channels, provide 1-inch diameter drain holes 2 feet on center to facilitate drainage of water if panels are washed.

3. Install ceiling panels flush against the ceiling surface, with no air space, using Z and hat section aluminum channels similar to the wall installation, or using stick pins with large aluminum button washers plus stick clips along the panel perimeter, 1 foot 6 inches on center, or using other approved retention devices.
4. Install ceiling panels only on the main ceiling surfaces between beams. Do not be use on the beams themselves.
5. Seal all exposed panel edges with spray adhesive.
6. Cover all butt joints of individual wall panels with a T-section aluminum channel anchored to the concrete wall using clips and drilled fasteners.
7. Cut wall panels at pipe penetrations and other surface interruptions, and trim exposed edges with Z section aluminum channels.
8. Eliminate panels in areas where the panel width would be less than 12 inches, and in other areas determined by the Project Representative. The equivalent value of any eliminated panels shall be installed at other unscheduled locations designated by the Project Representative.

### **3.02 FIELD TESTING**

- A. Perform tests for acoustical spay-on ceiling to verify that the applied average thicknesses meet the specification requirements.
- B. Inspect sample areas at a maximum of 6 locations, 1 inch by 3 feet for every 10,000 square feet of installed material.
- C. Use a yardstick with 3 spikes protruding through it, equidistant to each other, as a checking tool.
- D. Correct rejected work to the satisfaction of the Project Representative.

**END OF SECTION**

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**SECTION 09510**  
**ACOUSTICAL CEILING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies acoustical ceiling lay-in panels and support system, including lay-in panels and suspended metal grid system complete with wall and bulkhead trim.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C635	Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636	Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
Fed Spec SS-S-118B Standard 47-18	Sound Controlling (Acoustical) Panels and Tiles

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Manufacturer's data for tile.
- C. Samples: 3 samples of each type of acoustical unit.

**1.04 PRODUCT HANDLING**

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

**1.05 ENVIRONMENTAL CONDITIONS**

- A. Do not install acoustical ceilings until dust-generating activities have terminated and overhead mechanical work is completed, tested, and approved.
- B. Permit wet work to dry prior to commencement of installation.

## **PART 2 PRODUCTS**

### **2.01 ACOUSTICAL CEILINGS (ACT-51)**

- A. Acceptable manufacturer:
  - 1. Armstrong Company. Optima Tegular.
  - 2. Celotex Corporation.
  - 3. Conwed Corporation.
  - 4. United States Gypsum Company.
  - 5. Approved Equal.
- B. Exposed suspended grid:
  - 1. General: Panel manufacturer's 9/16" suspended exposed tee directly hung from the structure above and in accordance with requirements of ASTM C 635 (intermediate classification).
  - 2. Grid: Suprafine XL
    - a. Fire and non-fire rated exposed grid suspension.
    - b. Armstrong Low-Gloss type Main Runner Item 7501.
    - c. Cross Tees XL7520.
    - d. Wall Angle 7874.
    - e. Grid of 24-gage electro-galvanized steel finished with low-sheen satin white.
  - 3. Accessories: Wire hangers.
- C. Acoustical lay-in panels:
  - 1. Size: 24 inches by 96 inches.
  - 2. In compliance with Fed Spec SS-S-118B Type III Class A carrying UL, Inc. label, LR Grade 1.
  - 3. Non-fire rated: Minimum 1-inch thick.
  - 4. Noise control: NRC rating .95.
  - 5. Color: factory-applied washable white matte paint finish.
  - 6. Panel type: white, non-directional, fissured, non-rated or similar.
  - 7. Tile edges: square tegular 9/16".
- D. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 SURFACE CONDITIONS**

- A. Inspection: Prior to all work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Coordination:
  - 1. Install ceiling support system to fit around mechanical and electrical systems and equipment as required.
  - 2. Make necessary adjustments in wire hanger locations to accomplish this work.
- C. Discrepancies:
  - 1. In the event of discrepancy, immediately notify the Project Representative.
  - 2. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.02 INSTALLATION OF EXPOSED GRID SYSTEM**

- A. Directly hang, install the exposed grid system in accordance with ASTM C636. Deflection of any component shall not exceed 1/360 of the span.



- B. Install finish surfaces level and true within 1/8-inch per 12 feet of surfaces in any direction.
- C. Hang main tees spaced 24 inches O.C. with hanger wires spaced not over 48 inches along the length of the tees.
- D. Maximum runner rotation from plumb not to exceed 2 degrees.
- E. Attach cross-tees to main tees at 48 inches O.C.
- F. Provide perimeter angle moldings at intersection of ceiling panels and all vertical surfaces.
- G. Laterally brace ceiling areas exceeding 144 square feet in accordance with UBC Standard 47-18.

### **3.03 INSTALLATION OF LAY-IN PANELS**

- A. Plan each layout to balance border widths at opposite edges of each ceiling area. Avoid use of less-than-half width units wherever possible.
- B. Orient each panel in the same direction to produce a uniform direction of pattern.
- C. Install edge moldings at intersection of ceiling, ceiling fan, and vertical surfaces, using maximum lengths, straight, true to line and level. Miter corners.
- D. Install after all above-ceiling work is complete.
- E. Coordinate the location of hangers with other work.
- F. Ensure the layout of hangers are located to accommodate fittings and units of equipment, which may be placed after the installation of ceiling grid system.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest adjacent hangers and related carrying channels as required to span the required distance.
- H. Hang independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members. Hangers shall not pass through mechanical or electrical ductwork.
- I. Do not support fixtures from or on main runners or cross runners if weight of the fixture causes the total dead load to exceed the deflection capability. In such cases, support fixture loads by supplementary hangers located within 6 inches of each corner, or support the fixtures independently.
- J. Fit acoustic lay-in panels in place, free from damaged edges or other defects detrimental to appearance and function. Fit border units neatly against abutting surfaces.
- K. Install lay-in panels level, in uniform plane and free from twist, warp and dents.
- L. Do not install fixtures so that main runners and cross runners will be eccentrically loaded. Where fixture installation would produce rotation of runners, provide stabilizer bars.
- M. Adjust any sags or twists, which develop in the ceiling system(s) and replace any part that is damaged or faulty.

### **3.04 CLEANUP**

- A. Completely remove all fingerprints and traces of adhesives or soil and damage from the surfaces of acoustical materials, using only those cleaning materials recommended for that purpose by the manufacturer of the material being cleaned.
- B. Replace damaged or marred units.

**END OF SECTION**

## SECTION 09520

### METAL ACOUSTICAL WALL AND CEILING PANELS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies metal acoustical wall panels and metal acoustical ceiling panels.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C423	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C553	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Shop drawings:
1. Layout drawings:
    - a. Scaled drawing showing location of each unit, mounting and anchorage details.
    - b. Minimum plan drawing scale: 1/8 inch = 1 ft.
    - c. Minimum detail scale: 1-1/2 inch = 1 ft.
  2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.

#### PART 2 PRODUCTS

##### 2.01 ACCEPTABLE MANUFACTURERS

- A. Acoustical wall and ceiling panels:
1. ALPRO Acoustics.
  2. Eckel Industries Inc.
  3. Fry Reglet.
  4. Approved Equal.

## **2.02 MATERIALS**

- A. Facing: Steel, galvanized, ASTM A653, G60 coating.
- B. Brackets: Steel, galvanized, ASTM A653, G60 coating.
- C. Acoustical Insulation: Fiberglass, ASTM C553.
- D. Acoustical Insulation Protective Wrap: Polyethylene or vinyl.
- E. Fasteners: Steel, galvanized, ASTM A153.

## **2.03 MANUFACTURED UNITS**

- A. Panel Facing:
  - 1. 22 gage steel galvanized per ASTM A653, G60 coating minimum.
  - 2. Perforated with 3/32 inch holes on 5/32 inch staggered centers.
  - 3. Provide minimum of two (2) framing members on each side of panel for panels 96 inch long or less.
    - a. Panels over 96 inch long shall have minimum three (3) framing members on each side of panel.
  - 4. Finish:
    - a. Manufacturer's standard white polyurethane enamel finish.
  - 5. Size: 30 inch wide by length indicated in the Drawings.
  - 6. Profile: Similar to Eckel "EFP".
- B. Framing Members, Suspension and Stand-off Brackets:
  - 1. Minimum 20 gage.
  - 2. To match facing material.
  - 3. Adjustable height, stand-off and suspension brackets to accommodate field conditions.
- C. Acoustical Insulation:
  - 1. 2 inch thick, meeting ASTM C553.
  - 2. 4 lb/cf density minimum.
    - a. Poly wrapped.
  - 3. Fire rated in accordance with ASTM E84.
    - a. Flame spread: 10.
    - b. Smoke density: 5.

## **2.04 ACCESSORIES**

- A. Provide all attachment brackets, bolts, screws, washers, inserts, and other miscellaneous items required for complete installation.

## **2.05 SOURCE QUALITY CONTROL**

- A. Panels shall be laboratory tested to verify sound absorption in accordance with ASTM C423.

## **2.06 MAINTENANCE MATERIALS**

- A. Provide County with following maintenance material:
  - 1. Minimum of 2 ounces of touch-up paint in color selected for each 1000 sf or fraction thereof of panel surface.
  - 2. Minimum of 10 lb of acoustical insulation of type specified for Project.

## **2.07 SUSTAINABILITY**

- A. Sustainability Requirements: Section 01350.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Verify all above panel work has been completed for ceiling suspended panels prior to installation.
- B. Verify all behind panel work has been completed for wall mounted panels prior to installation.

### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Location and length of panels are indicated in the Drawings.
- C. Provide necessary clips and or suspension framing to mount units at height or offset indicated.

### **3.03 FIELD QUALITY CONTROL**

- A. Repair tears in acoustical wrap with tape recommended by manufacturer.
  - 1. Tape color to match acoustical wrap color.
- B. Touch-up paint all damaged panels.

**END OF SECTION**

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## SECTION 09530

### SOUND ABSORPTIVE INTERIOR PANELS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies acoustical panels in specific areas where high noise levels from equipment are known to exist.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM C423	Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Method

- B. Inspection:
  - 1. The Project Representative shall be advised of any unsatisfactory condition and the Contractor shall effect any necessary corrections.
  - 2. Start of the work shall imply acceptance of the surface and the Contractor shall assume responsibility for and rectify any of the resulting work found to be unsatisfactory.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. A complete description of the products and accessories in sufficient detail to demonstrate compliance with these Specifications.
- C. Drawings including plans and sections showing details, elevation, and locations of panel section in each room where panels are required.
- D. Samples of all materials specified herein.
- E. Acoustic panel support calculations as specified in Section 01031.

#### PART 2 PRODUCTS

##### 2.01 GENERAL

- A. All acoustical materials and attachment systems shall comply with pertinent local codes and regulations.

## 2.02 INDUSTRIAL ACOUSTICAL PANELS

### A. General:

1. Acceptable manufacturer:
  - a. Owens Corning Fiberglas.
  - b. Kinetics Noise Control.
  - c. Approved Equal.
2. The following rooms shall be treated with ceiling panels and with wall panels on all walls:

Room No.	Room Name	Area	Coverage	Notes
900.150	Standby Generator Room	All walls	25%	Required for wall coverage 7'2" above floor
900.150	Standby Generator Room	Ceiling	25%	
300.104	C2 Room	All walls	25%	Required for wall coverage 7'2" above floor
300.104	C2 Room	Ceiling	25%	
500.101	Pump Room	All walls	25%	Required for wall coverage 7'2" above floor
500.101	Pump Room	Ceiling	25%	

### B. Materials:

1. Core material:
  - a. Panel core shall consist of 2 IN thick rigid, unfaced glass fiber.
  - b. Edges shall be square and resin hardened.
2. Covering and hardware:
  - a. Panel shall be furnished with a reinforced Tedlar PVC film applied directly over the face and edges of the panel returned to the back for full finished edges.
  - b. Back of the panel is sealed with a reinforced poly-scrim.
  - c. Panel shall be hand washable and wipeable with water and mild detergent.
3. Sizes:
  - a. Panel shall be manufactured according to field dimensions supplied by the installing contractor.
  - b. Field verify all dimensions before production of panels.
4. Mounting:
  - a. Manufacturer shall supply mechanical clips for concealed mounting.
  - b. Panel mounting shall allow for panel removal, reinstallation and replacement without additional special tools or hardware.
  - c. A positive screw down bracket shall be provided to secure panels to the surfaces.
  - d. All mounting accessories used for installation shall be stainless steel.
5. Flammability: All panel components shall have a Class "A".

- C. Performance Requirements: Panels shall have a Noise Reduction Coefficient (NRC) of 0.95 and shall provide the following sound absorption coefficients when tested in accordance with ASTM C423 using Standard Mounting Type A:

Frequency, Hz							
	125	250	500	1000	2000	4000	NRC
Absorption	0.25	0.80	0.95	0.95	0.80	0.65	0.95



## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install plumb and in true alignment. Panels shall be installed according to manufacturer's recommendations and instructions.
- B. Installation of panels shall not begin until all wet work is completed. Building shall be properly closed in and under standard occupancy conditions (temperature of 60-85 degrees F, and not more than 90% relative Humidity).
- C. Locate panels where placement of these panels will not impede operational access to mechanical and electrical equipments or components.
- D. Panels shall be installed in a symmetrical array or pattern as much as possible. Coordinate placement of the panels with the Project Representative prior to installation.

**END OF SECTION**

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## SECTION 09650

### RESILIENT BASE AND ACCESSORIES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies resilient base and accessories.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM D5116	Guide for Small Scale Environmental Chamber Determination of Organic Emissions from Indoor Materials/Products.
ASTM F1861	Standard Specification for Resilient Wall Base.
RFCI	US Resilient Floor Covering Institute, FloorScore Standard; current edition.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Literature: Submit manufacturer's product literature for resilient base and adhesives.
- C. Samples: For each type and color of resilient base scheduled, submit 3 samples, not less than 12 inches in length.

##### 1.04 ENVIRONMENTAL REQUIREMENTS

- A. Maintain minimum 70 degrees F air temperature at base installation area for three days prior to, during, and for 24 hours after installation.
- B. Store base materials in area of application; allow materials to acclimate to environmental conditions prior to installation.

##### 1.05 MAINTENANCE

- A. Prior to project closeout, deliver 5 percent of installed quantity of each color and configuration of base material.
- B. Clearly identify each box or roll.

#### PART 2 PRODUCTS

##### 2.01 RESILIENT BASE

- A. Acceptable Manufacturers:
  - 1. Roppe Rubber Corp.
  - 2. Flexco, Inc.

3. Johnsonite.
  4. BurkeMercer Flooring Products / Burke Industries.
  5. Armstrong Floor Division.
  6. Approved Equal.
- B. Resilient Base: ASTM F1861, Type TS, 100 percent vulcanized rubber; 1/8 inch thick; roll stock; coved and straight base as specified; 6 inch height, color: match Johnsonite 23 "Vapor Grey".

## **2.02 OTHER MATERIALS**

- A. Adhesives:
1. Use adhesives as recommended by the wall base manufacturer for the application.
  2. Maximum VOC content of less than 50 grams/liter.
- B. Sealant: General purpose butyl rubber sealant; color as selected by the installer for match to base or flooring color.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
- B. Discrepancies: In the event of discrepancy, immediately notify the Project Representative. Do not proceed with installation in subject areas until discrepancies have been fully resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 BASE INSTALLATION**

- A. Adhesive install base materials. Install adhesive in a continuous bead behind top of base to ensure uniform contact with substrate, without gaps.
1. Install coved style base where indicated in combination with hard surface or resilient flooring.
- B. Install base to walls and to wood casework toe kicks in areas where resilient base is scheduled, and where no other base finish is specifically noted or detailed.
- C. Install base in maximum practical lengths, with minimum number of joints in each run. Fit joints tight, vertical, and in accurate alignment.
- D. Field Installed Corners:
1. Outside Corners: Score back of base material with grooving tool, at outside corners; maintain minimum leg length 18 inches where wall length permits. Mount base so that scored groove is accurately aligned with corner, and with base tightly adhered to wall at both sides of corner, with no visible gaps at top of base. Where cove base is formed around outside corners, stretch toe of cove for smooth transition around corner, with toe in uniform contact with the finish flooring.
  2. Inside Corners: Miter or cope inside corners for accurate fit.
- E. Scribe and fit to door frames, stairs, and other obstructions.
- F. Install straight and level to maximum variation of plus or minus 1/8 inch over 10 feet.

- G. Solvent or adhesive weld joints in base and seal toe of base to floor in janitor's closets.
  - 1. Where coved base is installed against hard surface or resilient flooring, install a continuous bead of sealant under the toe of the base; ensure complete contact to exclude moisture between the floor and the base. Remove squeezeout with xylol, mineral spirits, or other solvent as recommended by the sealant manufacturer.

### **3.03 CLEANING**

- A. Upon completion of the installation, immediately remove surplus adhesive from base and adjacent surfaces.

**END OF SECTION**

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## SECTION 09671

### CONCRETE FLOOR SEALER

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies concrete floor sealer.

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: For floor sealer.

##### 1.04 PROJECT CONDITIONS

- A. Conform to manufacturer's instructions.

##### 1.05 SEQUENCING AND SCHEDULING

- A. Schedule the final application of the concrete sealer immediately prior to Substantial Completion.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS AND SYSTEMS

- A. Concrete Sealer:
  - 1. Acceptable Products:
    - a. US Spec Hydrasheen 30%.
    - b. Approved Equal.
  - 2. ASTM C309; water based curing compound; VOC 100g/L or less.
  - 3. VOC Content: In accordance with the South Coast Air Quality Management District (SCAQMD) Rule 1113; Effective July 1, 2005 and rule amendment January 7, 2005.

#### PART 3 EXECUTION

##### 3.01 EXAMINATION

- A. Prior to starting Work, carefully inspect installed Work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

- B. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- C. Do not begin Work until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Cover and protect surfaces not to receive concrete sealer.
- B. Clean concrete surfaces to remove dirt, oil, grease, adhesives, joint compound, and other surface contamination. Use cleaner as recommended by the concrete sealer manufacturer.
- C. Allow surfaces to dry.

### **3.03 APPLICATION**

- A. Apply concrete sealer in accordance with the manufacturer's recommendations.
- B. Apply 2 coats.

### **3.04 CLEANING**

- A. Leave area clean, free from spillage, overspray, tracking, and other residue resulting from work of this Section.

**END OF SECTION**



## SECTION 09720

### STRETCHED FABRIC PANELS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies:
  - 1. Track mounted fabric wall covering system (FWP-51).

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revisions of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of the Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM E84	Test Method for Surface Burning Characteristics of Building Materials.
ASTM C423	Standard Test Method for Surface Burning Characteristics of Building Materials.
ASTM D5034	Standard Test Method for Testing Breaking Loads of Textiles in a Holding Fixture.
NFPA 701	Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

- B. Mock-Ups:
  - 1. Comply with provisions of this Section.
  - 2. In location as directed, install four adjacent panels, including batting and fabric.
  - 3. Mock-up shall be ready for review prior to pre-installation conference.
  - 4. Approved mock-up panels may be incorporated into the Work.
- C. Pre-Installation Conference:
  - 1. Comply with provisions of this Section.
  - 2. Schedule conference a minimum of 7 calendar days prior to the installation of the wall covering.
  - 3. Agenda: Review mock-up; review installation, including locations of each fabric type, substrate requirements, and installation procedures and methods. Request that all conditions and situations which would adversely affect the track mounted fabric panel application be addressed.
  - 4. Attendance: Contractor, Project Representative, track mounted fabric panel installer, and other entities affected by the work of this Section.
- D. Fire Retardant Rating: Components of track mounted fabric panel systems shall have a flame spread of 25 or less and a smoke developed of 200 or less when tested in accordance ASTM E84.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Manufacturer's complete product literature and installation instructions for track mounted wall covering system.
- C. Samples: Three minimum 12 x 12 inch samples of each fabric proposed.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. In accordance with this Section.
- B. Upon receipt of wall coverings, unroll and inspect all materials for defects. Notify Project Representative of all defective materials.
- C. Store wall coverings flat, not upright, in a dry secured area. Maintain temperature at a minimum of 45 degrees F, unless a higher temperature is recommended by wall covering manufacturer. Maintain humidity normal to the space or area where the wall covering is to be installed.
- D. Acclimate fabrics minimum 24 hours at temperature and humidity approximating that of occupancy prior to installation.
- E. Protect fabrics from damage.

#### **1.05 ENVIRONMENTAL CONDITIONS**

- A. Temperature:
  - 1. Do no wall covering work until surfaces and materials have been maintained at 60 degrees F, minimum, or higher if recommended by wall covering manufacturer, for 24 hours before work begins.
  - 2. Maintain minimum or above temperatures during the entire time of installation.
- B. Lighting: Maintain minimum lighting level of 15 foot-candles on the surfaces to receive wall covering, using temporary lighting, if necessary, to attain specified level.

#### **1.06 WARRANTY**

- A. Installer's Guarantee: 1 year unlimited guarantee against defects in materials and workmanship.
- B. Manufacturer's Warranty: Track system manufacturer's standard 5 year limited warranty against defects in mounting system materials.

#### **1.07 MAINTENANCE**

- A. Furnish equivalent of 10 percent of installed quantity of fabric; sizes as necessary for installation as a single piece in a discreet panel area. Overage fabric which is used to satisfy extra stock requirements shall be free of damaged or stained material.
- B. Deliver to Project Representative at a location on site, as directed, in clearly marked sealed cartons.

### **PART 2 PRODUCTS**

#### **2.01 TRACK SYSTEM**

- A. Acceptable Manufacturers:
  - 1. Basis of Design: Snap-Tex Systems Inc..
  - 2. Acceptable Options (subject to compliance with specification requirements):
    - a. FabriTRAK® Systems, Inc.
    - b. Accutrack Systems.
    - c. "Whisper Walls" by Innerspace Control Systems Inc.
    - d. Approved Equal.

- B. Concealed Track Mounting System: "Snap-Tex Fabric Upholstery System"; manufacturer's standard fire retardant rigid vinyl framework; 1/2 inch profile; square configuration. 3/8 inch deep systems may be used, provided concealed spacers are used to obtain the 1/2 inch depth.

## **2.02 SYSTEM COMPONENTS**

- A. Fabric: Kvadrat Maharam "Divina Melange" 460830, Color 120, 59 inches wide; treat for ASTM E84, Class A.
- B. Non-Acoustical Tackable Backing: 1/2 inch thick board; USG "Micore 300," or Approved Equal; flame spread of 25 or less when tested in accordance with ASTM E84.
- C. Accessories:
  - 1. Blocking for items mounted over surface of fabric: Fire retardant treated wood.
- D. Accessories: Furnish fasteners, switch and outlet plate extensions, blocking, and other materials as required for a complete installation.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Verify the type, pattern, color, and quantity of each type wall covering for each location scheduled to receive wall covering.
- B. Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, and fastenings prior to starting work; store during and replace after Work.
- C. At locations where electrical cover plates, hooks, or other similar hardware are indicated for application over stretched fabric panels, provide wood or plywood blocking of thickness to match track depth. Anchor blocking securely to face of gypsum board substrate; screw through to framing wherever practical.
- D. Use wall covering adhesive or gypsum board adhesive to install tackable backing, layered or shimmed to match system thickness.
- E. Field measure each wall area scheduled to receive track mounted wall covering.

### **3.03 INSTALLATION OF TRACK MOUNTED FABRIC**

- A. Install track framework as indicated and in strict accordance with the track manufacturer's printed instructions. Corners shall be neatly folded for uniform appearance.
- B. Install batting continuous and flush to the shoulder of the track; cut neatly around backing for tight fit without voids between batting and blocking. .

- C. Stretch fabric taut and smooth set edges into locking jaws of track framework. Unless indicated otherwise, stretch fabric with weave straight and in parallel alignment with track members. Maintain pattern and weave alignment across joints between adjacent panels.
- D. Where called out in Drawings, fabric seams to be machine sewn tight straight seam with accurate pattern match. Where fabric panel dimensions exceeds fabric dimensions installer to contact the Project Representative to coordinate locations of any additional seams.

### **3.04 EXTRA YARDAGES**

- A. Notify Project Representative at the site prior to removing excess yardage from the job. The Project Representative will select the materials which are to be retained.
- B. Carefully wrap and mark the excess yardage selected to be retained. Note on an inventory sheet the type and locations where installed, and deliver to the Project Representative. Remove and dispose of remainder.

### **3.05 CLEANUP**

- A. Remove dust, dirt, and other contaminants in a manner which will not damage the surface from which it is removed. Trim and remove all loose threads.
- B. Remove debris and leave areas neat and clean.
- C. Reinstall all removed wall plates and other accessories.
- D. Repair to like-new condition, or replace with new, all construction damaged by work of this Section.

### **END OF SECTION**

## SECTION 09900

### COATING SYSTEMS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies coatings and their surface preparation for field and shop-applied coating systems.
- B. Furnish all labor, equipment, including safety equipment, superintendence, materials, tools and incidentals necessary to prepare and coat the work as specified in this Section.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following document. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
ASTM D3359	Standard Test Methods to Measure Adhesion by Tape Test
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4138	Standard Test Methods for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means
ASTM D4263	Standard Test Method Indicating Moisture in the Concrete by the Plastic Sheet Method
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating
ASTM D4259	Standard Practice for Abrading Concrete
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D4417	Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Method for Pull-off Adhesion
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers
ASTM E329	Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction
ASTM E337	Standard Test Method for Measuring Humidity With a Psychrometer
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ICRI	International Concrete Repair Institute, Technical Guidelines
MIL-A-22262A (SH)	Military Specification, Abrasive Blasting Media, Ship Hull Blast Clean
NACE SP-0188	Standard Practice, Low, High Voltage Electrical Inspection of Coatings, Discontinuity (Holiday) Testing of Protective Coatings.
SSPC	Steel Structures Painting Council, Volume 1 - Good Painting Practices
SSPC-Paint Application-PA-2	Measurement of Dry Paint Thickness with Type 2 Gauges
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
SSPC SP-5	White Metal Blast Cleaning
SSPC SP-7	Brush-Off Blast Cleaning
SSPC SP-10	Near-White Metal Blast Cleaning

Reference	Title
SSPC SP-11	Power Tool Cleaning to Bare Metal
SSPC SP-13/NACE 6	Surface Preparation of Concrete
SSPC SP-15	Commercial Grade Power Tool Cleaning
SSPC SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steel, and Non-Ferrous Metals
SSPC-VIS 1-67T	Visual Plates Used to Determine Blasting Standards
SSPC - Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC - Guide 15	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates
SSPC Publication 91-12	Coating and Lining Inspection Manual

B. Quality Assurance/Quality Control (QA/QC) for Shop and Field:

1. General:

- a. Manufacturer's printed instructions: Deviations from the manufacturer's printed instructions will not be allowed unless approved in writing by the manufacturer's technical representative and the Project Representative before execution of said change.
- b. In the event of a disagreement between the manufacturer's printed instructions and the provisions of Section 09900 the provisions of Section 09900 shall prevail.
- c. Test result disagreement: In the event of a discrepancy between the Contractor and Project Representative's testing equipment, both parties shall check equipment in question for proper function and calibration.
- d. Make available all locations and phases of the work for access for inspection by the Project Representative or the manufacturer's representative. Contractor shall provide ventilation, egress, staging and whatever other means are required to access the work area.
- e. Contractor QC personnel shall be certified as National Association of Corrosion Engineers, (NACE) CIP, Level 1, for coating work performed at the project site. Contractor QC personnel shall be certified as National Association of Corrosion Engineers, (NACE) CIP, Level 3 with Peer Review, for coating work performed away from the project Site.
- f. The Project Representative may approve the application of coatings specified under this section by the Contractor's fabricators and other suppliers without direct inspection by the County provided that the fabricators and suppliers meet the requirements of 1.02.B.1 and 1.02.B.2.

2. Contractor's responsibilities:

- a. Quality control: responsible for the quality control of the coatings applied and performing check points as specified in this Section.
- b. Schedule: prepare a schedule that is updated weekly or as necessary to show QC and QA Check Points as specified herein, and distribute to all parties related to installation of the coating system. The schedule shall allow time for remedial work to be completed as identified by inspection at the given checkpoints. The Project Representative shall be informed within 24 hours prior to the Contractor performing the tests specified.
- c. Reports: prepare daily inspection reports when any work is performed on site. Project Representative may ask that ambient conditions be recorded as often as needed to insure specified application conditions are met, but not less than twice daily. Use the "Daily Inspection Report" form found in Section 01999. Submit copies of this report within 24 hours of coating application to the Project Representative for signature to acknowledge the report was timely produced. Submit all reports in bound form at the completion of coating work.
- d. Over coating: verify coating compatibility and primer quality to be equal to the specified primer when over-coating a primer or coating that was applied by others.
- e. Provide testing equipment required in this Section and as required to verify compliance with the Specifications. Record of equipment calibration shall also be provided.

3. Project Representative's responsibility:

- a. QA: determine acceptance or rejection of a coating based on the given Specifications.
- b. Testing: may conduct tests on ambient conditions, surface temperature, coating(s) applied, target mil thickness, coating type (i.e. stripe coat), and coating batch numbers.

4. Checkpoints: Contractor is responsible to perform the checkpoints specified below and as required in COATSPEC. The Project Representative may perform any or all of the checkpoints listed in addition to, but not replacement of, the requirement for the Contractor to perform the inspection checkpoints as specified below.
- a. Check Point 1. Blotter test: Upon start up of abrasive blasting, compressed air shall be checked daily for oil and water by blotter test per ASTM D4285.
  - b. Check Point 2. Anchor profile:
    - 1) Anchor profile of an abrasively blasted metal surface shall be tested using Testex tape per ASTM D4417.
    - 2) Surface profile of an abrasively blasted concrete surface shall be determined through comparison with ICRI surface finish comparator placards.
    - 3) Test shall be conducted on the start up of the blasting operation to insure proper selection of blast media and prior to prime coat application.
  - c. Check Point 3. Intermediate DFT readings: DFT readings shall be taken between coats to check consistency of the application and progress toward total system thickness.
  - d. Check Point 4. Final DFT readings: DFT readings shall be taken per SSPC PA-2 on total system thickness as criteria for final acceptance of a coating. If recoat time has been exceeded or if recommended by the manufacturer, deficient areas shall be scarified prior to top coating. Dry film thickness measurements in excess of the amounts specified in SSPC PA-2 may be acceptable if approved by the Project Representative.
  - e. Check Point 5. Holiday testing: Perform for the entire coating per NACE SP 0188 in the presence of the Project Representative. Any holidays detected shall be repaired and retested after cure of the coating is complete.
  - f. Check Point 6. Surface preparation: Shall be accepted by the Project Representative prior to the application of a coating.
  - g. Check Point 7. Ambient conditions: Perform tests for relative humidity, surface temperature, dew point and ambient temperature to ensure compliance for materials applied.
  - h. Check Point 8. Adhesion: perform adhesion tests per ASTM D3359 or ASTM D7234 depending on the substrate. It is the responsibility of the Contractor to repair any damage to the coating resulting from adhesion testing.
    - 1) Minimum adhesion values for coatings specified in Coating System A-1, A-2 and A-3: 400 psi.
  - i. Check Point 9. Test to Determine Salt Contamination: Using the Bresle Method, the Contractor shall take 3 random tests each day during surface preparation prior to coating application. For immersed surfaces, the reading shall not exceed 30 microsiemens/cm (30 us/cm). For non-immersed surfaces, the reading shall not exceed 70 microsiemens/cm (70 us/cm). If conductivity measurements exceed the respective values, the affected surfaces shall be cleaned until conductivity levels are acceptable.
  - j. Check Point 10. Moisture in Concrete: perform ASTM 4263, Standard Test Method Indicating Moisture in the Concrete by the Plastic Sheet Method. If the presence of moisture is indicated, dry the substrate prior to coating application. Perform this test once for every 200 square feet of area to be coated and more frequently at darkened concrete areas. Perform Calcium Chloride Moisture Vapor Emissions Tests in accordance with ASTM F-1869 for all floors, containment, below grade applications or any other moisture tests required by the manufacturer.
  - k. Check Point 11. Test for de-passivation of galvanized steel: After cleaning galvanized steel by pressure wash and soap or other manufacturer-approved method, test every 100 square feet by applying a drop of Copper Sulfate test solution. Black color indicates that the galvanized steel has been de-passivated. Refer to Section 09900.
  - l. Check Point 12. Pressure washing QA/QC:
    - 1) Wash water temperature verification: Dispense wash water into a 5 gallon bucket. Verify that wash water is between 120F and 130F with a calibrated infrared thermometer.
    - 2) Pump flow rate- Spray wash water into a 5 gallon bucket. Water level shall rise to 3 gallon mark in 60 seconds or less.

- 3) Pump pressure- For a 3,000 PSI rated machine, the pressure at spray gun inlet shall be not less than 2,900 PSI with the trigger pulled and nozzle discharging water on a calibrated pressure gauge.
- 4) Nozzle orifice size: Example: A properly sized new #3.5 (.048") pressure washing nozzle will pass a # 56 (.0465") drill bit or drill blank but will not pass a # 55 (.052") drill bit or drill blank. A nozzle shall be replaced when its orifice passes a drill bit or drill blank .004" larger than the original orifice diameter.
5. Disputes: If questions arise concerning the acceptability of an applied coating, Tooke, adhesion, and other destructive/non-destructive tests may be performed to aid in resolution of the dispute. If the coating is determined to be defective: the Contractor will be responsible for the cost of repairs resulting from testing. If the coating is shown to be properly applied, the County will be responsible for the cost of inspection repairs.

### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Contractor QC personnel listed in Section 09900..
- C. Materials List: Organize to indicate painting systems to be used with each substrate. Include manufacturer's product data as required to verify compliance with the specified requirements. Do not include MSDS sheets.
- D. Samples:
  1. Paint Samples:
    - a. Submit three samples of each paint finish on an 8"x10" card. Reference manufacturer, type of paint, color, sheen, substrate, and application.
    - b. Furnish additional samples until all paint finishes are approved.
  2. For each prime and finish coating, furnish a 12-inch square sample that shall match sample provided in color, texture and sheen. Field and/or samples may be requested by the Project Representative.
  3. For Systems A-2, A-3, B-2 and C-3, submit manufacturer's details for construction joints, penetrations, crack repair, and details at floor penetrations, wall bases, equipment bolts, embedded angle frames, transitions and terminations of the system and all other details specific to the structure being coated.
- E. A Waste Disposal Plan.
- F. For each primer and finish coating, provide the manufacturer's application instructions, which shall include the following:
  1. Surface preparation recommendations.
  2. Primer type, where required.
  3. Maximum dry and wet mil thickness per coat.
  4. Minimum and maximum curing time between coats, including atmospheric conditions for each.
  5. Curing time before submergence in liquid.
  6. Thinner to be used with each coating.
  7. Ventilation requirements.
  8. Allowable application methods.
  9. Maximum storage life.
  10. Safety data sheets.
  11. Interpretation of batch code numbers.
  12. Minimum and maximum relative humidity requirements.
  13. Minimum and maximum surface temperature requirements.
  14. Minimum and maximum ambient temperature requirements.
  15. Manufacturer's recommended application procedure.
  16. When color is not specified, provide manufacturer's range of standard colors.



- G. Contractor QC personnel qualifications.
- H. Mock-ups:
  - 1. Provide mock-ups in accordance with 01430 and as listed below.
  - 2. Typical PT-51 Paint Color: Provide a minimum 100 square foot mock-up of the typical interior P-51 color in an area as approved by the Project Representative. Approved mock-up may be used in the Work.
  - 3. Accent Color PT-61, PT-62, and PT-63 Mock-up: Provide a minimum 100 square foot mock-up of each alternate Accent Color in an area as approved by the Project Representative. One of the accent colors to be selected based on mockup by Project Representative. Approved mock-up may be used in the Work.
- I. Provide information on blasting media including coating manufacture's recommended grit/shot size for coating systems specified.
- J. Daily inspection reports.
- K. Visual Standards: Each distinct area of the finished work shall be free of variations in color and sheen, orange peel, runs, sags, blistering, checking, cracking, scratches, dust, dirt, bugs, and other contaminants.

#### **1.04 DEFINITIONS**

- A. Coating systems: Includes surface description, surface preparation, required dry film thickness, and the number and application procedure of the prime and finish coatings. Systems are as specified within this Section on the Coating System Specification Sheets (COATSPEC).
- B. Field coating: The application of the coating system after installation of the surface at the work Site.
- C. Dry film thickness (DFT): The thickness of a fully cured coating or coating system.
- D. Wet film thickness (WFT): The thickness of a coating while wet.
- E. Volatile organic content (VOC): The portion of the coating that is a compound of carbon, is photo-chemically reactive and evaporates during drying or curing, expressed in grams per liter or pound per gallon as defined in ASTM D3960.
- F. Shop coat: One or more coats applied in a shop or plant prior to shipment to the Site.
- G. Lead containing: Any coating that contains any detectable amount of lead.
- H. Stripe coat: A coat of the specified coating, applied prior to the final coat by brush to all edges (cut or fabricated) on steel shapes, crevices, projections, welds, nuts, bolts, pits, flanges, and splice plates.
- I. Hard to reach: Areas that may not be accessible with spray equipment but can be reached by brush, mitt or roller.
- J. Inaccessible areas: Areas such as back-to-back angles, skip welds, and other areas that a brush, mitt, or roller cannot contact the surface.
- K. pH: A measure indicating whether a solution is acidic, neutral, or alkaline.
- L. GPM: Gallons per minute.

### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials for field application to the job site in their original, unopened containers. Each container shall bear the manufacturer's name brand, batch number, date of manufacture, and storage life.
- B. Coatings shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold. Coatings, exceeding storage life recommended by the manufacturer or that have been visibly damaged shall be removed from the site. Flammable materials shall be stored in accordance with state and local codes.

### **1.06 SITE CONDITIONS**

- A. Coatings shall be applied only to surfaces that are dry, and only under such combination of humidity and temperatures of the atmosphere and surfaces to be coated as will cause evaporation rather than condensation.
- B. During coating and for a period of at least 8 hours after the coating has been applied, the temperature of the surface and the atmosphere shall be maintained at a minimum of 5 degrees above the dew point.
- C. Provide environmental controls such as heaters and/or dehumidification if atmospheric requirements as specified herein are not met or workdays are lost due to weather.
- D. Supply ventilation if the cure time of the coating is slowed by the presence of coating or solvent vapor.

### **1.07 CONTAINMENT**

- A. Containment shall conform to SSPC-Guide 6. Level of containment shall be as specified to capture debris, contain dust, protect from adverse weather, and provide means to control ambient conditions, and shall be as specified for the material and service conditions in the COATSPEC.
- B. If containment is not required, do not spray apply coatings if wind velocity is above 15 mph or in any condition which could cause paint spray to drift to adjacent property. The Contractor is responsible for any damage resulting from surface preparation or painting operations.

## SSPC-GUIDE 6 - TABLE A

### COMBINATIONS OF CONTAINMENT AND VENTILATION SYSTEMS COMPONENTS

Containment Classification	CONTAINMENT SYSTEM (5.3 of Guide)						VENTILATION (5.4 of Guide)				
	5.3.1 Containment Materials	5.3.2 Penetrability	5.3.3 Support Structure	5.3.4 Joints	5.3.4 Joints	5.3.5 Entryway	5.4.1 Make-up	5.4.2 Input Air Flow	5.4.3 Air Pressure	5.4.4 Air Movement	5.4.5 Exhaust Dust Filtration
Class 1A		B1-Air Impenetrable	C1-Rigid C2-Flexible	D1-Full Seal	D1-Full Seal	E1-Airlock E2-Resealable	F1-Controlled	G1-Forced G2-Natural	H1-Instrument Verification H2-Visual Verification	I1-Minimum Specified	J1-Air Filtration
Class 2A	A1-Rigid A2-Flexible	B1-Air Impenetrable	C1-Rigid C2-Flexible	D1-Full Seal	D1-Full Seal	E2-Resealable E3-Overlap	F1-Controlled F2-Open	G1-Forced G2-Natural	H2-Visual Verification	I1-Minimum Specified	J1-Air Filtration
Class 3A	A1-Rigid A2-Flexible	B1-Air Impenetrable B2-Air Penetrable	C1-Rigid C2-Flexible	D1-Full Seal D2-Partial Seal	D1-Full Seal D2-Partial Seal	E4-Open Seam	F1-Controlled F2-Open	G1-Forced G2-Natural	H3-Not required	I2-Not specified	J1-Air Filtration
Class 4A	A1-Rigid A2-Flexible	B1-Air Impenetrable B2-Air Penetrable	C3-Minimal	D2-Partial Seal	D2-Partial Seal	E4-Open Seam	F2-Open	G2-Natural	H3-Not required	I2-Not specified	J2-No Controls on Exhaust

*Note 1: The information in this table is provided for guidance only and does not guarantee that any specific levels of containment will be achieved by following the suggestions. The type of structure, wind conditions, soundness of the materials of construction, and many other factors play a role in containing dust and debris.*

*Note 2: The table occasionally identifies two options for a given component. For example, containment materials (5.3.1) are shown as being either rigid or flexible. If the specifier requires the use of rigid materials only, this restriction shall be specified separately.*

*Note 3: The design suggestions made in this table are based on the use of open abrasive blast cleaning inside containment. The classifications are ordered from the greatest degree of dust and debris containment (Class 1A). Normally, the higher the degree of containment, the higher the cost.*

*Note 4: Many other combinations of the components beyond those suggested above can be used to provide similar results. The method preparation can also be adjusted to reduce or eliminate dust emissions.*

*Note 5: Certain combinations of components within which each class may not be suitable when removing hazardous paints (e.g., forced air input in combination with penetrable containment materials in Class 3A).*

*Note 6: When designing a ventilation system, care shall be taken to balance the static pressure with the input air flow to avoid collapsing the containment due to high negative pressure.*

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Standardization:
  - 1. Materials, supplies, and articles provided shall be the standard products of manufacturers. Coatings in a particular system shall be the products of a single manufacturer.
  - 2. The standard products of manufacturers other than those specified may be accepted when it is demonstrated that they are equal in composition, durability, usefulness, and convenience for the purpose intended. Requests for substitutions will be considered when submitted per Section 01300 provided the following minimum conditions are met:
    - a. The proposed coating system shall use an equal or greater number of separate coats to achieve the required dry film thickness.
    - b. The proposed coating system shall use coatings of the same generic type. The directions for application and descriptive literature which includes generic type, non-volatile content by volume, material safety data sheets, VOC's by grams per liter, and other information confirms that the substitution is equal to the specified coating system.
    - c. Certified laboratory data sheets showing the results of complete spectrographic and durability tests performed on the proposed substitute. Tests shall be performed by a laboratory, which conform to the provisions of ASTM E329 and, which shall be a member of the American Council of Independent Laboratories.
- B. All coating materials shall not contain benzene, exceed 150 grams per liter of volatile organic compounds (VOC), or be lead containing.
- C. Blasting material shall meet MIL-A-22262A (SH) and shall be arsenic-free and contain no free silica. Blasting material shall not be reused. The Contractor is responsible for removing and legally disposing of the spent blasting material from the job site. The Contractor shall provide a copy of total characteristic leaching procedure (TCLP) results of the spent blast material to the Project Representative prior to Final Acceptance of the Work.
- D. Nonskid additive shall be 20 to 40 mesh alumina oxide, unless alternate nonskid media is recommended by the manufacturer.

### **2.02 EQUIPMENT**

- A. The Contractor is responsible for ensuring that all County equipment including mechanical working parts and/or moving parts within the work area are protected from damage. Protection of equipment will be coordinated with the Project Representative.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. General:
  - 1. Surfaces to be coated shall be clean. Before applying coating, oil and grease shall be removed per SSPC SP-1. All dirt, rust, loose mill scale, old weathered coatings, and other foreign substances shall be cleaned according to the SSPC standards specified in the COATSPEC. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded, and free of contaminants, which might interfere with the adhesion of the coatings.

2. Clean cloths and clean fluids shall be used in solvent cleaning. Cleaning and coating shall be scheduled so that dust and spray from the cleaning process will not fall on wet, newly coated surfaces. Ensure that field coating is compatible with factory applied or existing coatings.

B. Metallic surfaces:

1. Metallic surfaces shall be prepared in accordance with applicable portions of surface preparation specifications of the SSPC. Specific applicable standards are specified in each coating system. The solvent in solvent cleaning operations shall be as recommended by the manufacturer.
2. Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS-1-67T, or as described herein. To facilitate inspection on the first day of sandblasting operations, sandblast metal panels to the standards specified. Plates of light metal steel shall measure a minimum of 8-1/2 inches x 11 inches. Panels meeting the requirements of the Specifications shall be initialed by the Contractor and the Project Representative and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of sandblasting and shall be used as the comparison standard throughout the Work.
3. Profile of blasted surfaces of new steel or previously coated steel shall be per the manufacturer's recommendation for each coating system but be no less than two mils. Tightly adhered, existing coating remaining on surface following SSPC SP-7, cleaning shall have a minimum surface profile of 2 mils.
4. Surface preparation for aluminum, copper, brass, and stainless steel shall be as specified for the coating in the COATSPEC.
5. Surface preparation for galvanized metal shall include a pressure wash with a cleaning solution recommended by the coating manufacturer, mixed and rinsed with 130-degree water and applied at 3000 psi, 2.8 GPM minimum. When the surface is dry, prepare for coating application by providing a cleaning per SSPC SP-7, SP-11, or SP-16. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application. Perform de-passivation test as specified herein.
6. Areas not accessible or appropriate for blast cleaning may be hand tool cleaned per SSPC SP-2 or power tool cleaned per SSPC SP-3 with written approval of the Project Representative.

C. Concrete, masonry and plaster surfaces:

1. Surfaces, which are coated shall be allowed to age for at least 28 days or longer, to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested per ASTM D4263. The presence of moisture indicates additional cure time will be required. Retest as required until concrete is sufficiently dry for coating.
2. Muriatic acid solution shall not be used.
3. Loose concrete and laitance shall be removed by blasting and chipping. Voids and cracks shall be repaired as specified in Section 03300. When repair work in Section 03300 is complete, prepare the surface per the following:
  - a. Concrete floors shall be prepared with "blast track" style equipment or an Approved Equal.
  - b. All concrete surfaces shall be inspected per SSPC SP-13 to ICRI Technical Guideline #310.2-1997 and per the manufacturer's recommendations.
4. Surfaces shall be dry and clean and free from grit, loose plaster, and surface irregularities.
5. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sanded smooth. Surfaces may require additional repair to provide a smooth surface prior to application of final coat.
6. The pH of the surface shall register a '7', which indicates a neutral surface condition, before coating is applied. If indicator reads above '7', the alkali shall be neutralized.
7. Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.
8. Steam cleaning shall be used to clean wall surfaces of existing process channels, structures and tanks to be coated.
9. Surfaces to be coated shall be repaired as specified in 3.07, and cleaned and finished to the standards as specified herein.

- D. Ductile Iron Pipe:
  - 1. As specified in 15062.
- E. Plastic surfaces:
  - 1. Clean with solvent compatible with the specified primer and hand sanded with a medium grit sandpaper to provide sufficient profile for the coating system. Large areas may be power sanded or brush off blasted provided sufficient controls are employed so the surface is roughened without removing excess material.

### 3.02 APPLICATION

- A. Workmanship: Coating shall be conducted in accordance with the requirements of SSPC, Good Painting Practice, Volume 1.
  - 1. Coated surfaces shall be free from runs, drips, ridges, waves, laps and brush marks. Coats shall be applied so as to produce an even film of uniform thickness.
  - 2. Coating equipment shall be designed for application of the materials specified.
    - a. Compressors shall have traps and filters to remove water and oils.
    - b. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators, and spray nozzles of the proper sizes and functioning in a manner suitable to perform the Work.
  - 3. Each coat of paint shall be applied evenly and sharply cut to line.
- B. Coating properties, mixing, and thinning:
  - 1. Coating shall provide a satisfactory film with smooth even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Orange Peel, overspray, pinholes and other surface defects shall be repaired.
  - 2. Coating shall be thoroughly stirred, strained, and kept at a uniform consistency during application.
  - 3. Coatings shall be mixed in accordance with the manufacturer's instructions.
- C. Method of coating application:
  - 1. Prime coatings may be shop or field applied. Shop-applied primer shall be as specified in each system.
  - 2. Provide mechanical equipment, including: pumps, valves, pipe, blowers, fittings, and miscellaneous appurtenances, with shop-applied primer and shop-applied finish coats.
  - 3. If the shop coating meets the requirements of this Section, the field coating may consist of touching up the shop prime coat to achieve the film thickness, continuity, and coating specified in the COATSPEC. Damaged and poorly applied shop coatings that do not meet the specified requirements shall be removed, surface prepared, and then recoated in accordance with the COATSPEC.
  - 4. Where two or more coats are required, alternate coats shall contain sufficient compatible color additive, to act as indicator of coverage or the alternate coats shall be of contrasting colors.
  - 5. Mechanical equipment on which the manufacturer's shop-applied coating is acceptable shall be touch-up primed and coated with the specified coating system to match the color scheduled.
  - 6. Coating shall not be applied to a surface until it has been prepared as specified.
  - 7. A stripe coat shall be applied by brush to all edges (cut or fabricated), crevices, projections, nuts, bolts, pits, welds, flanges and splice plates. Subsequent coats may be either brush or spray applied.
  - 8. Where nonskid surface is scheduled, broadcast nonskid additive at 5 pounds per 30 square feet. Backroll on horizontal surfaces.
- D. Film thickness and continuity:
  - 1. Coating system thickness is the total thickness of primer and finish coats and does not include sealers, patching mortars or galvanized coatings.
  - 2. Coatings shall be applied to the thickness specified. No less than two coats shall be applied.

- E. Unsatisfactory Application:
  - 1. If an item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
  - 2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
  - 3. Repair defects in accordance with written recommendations of coating.
- F. Damaged Coatings, Pinholes, and Holidays:
  - 1. Feather edges and repair in accordance with recommendations of paint manufacturer.
  - 2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
  - 3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

### **3.03 CLEANUP AND WASTE DISPOSAL**

- A. At the end of each shift, remove surplus materials, protective coverings, and accumulated rubbish.
- B. Thoroughly clean all surfaces and repair any overspray or other paint-related damage when the work is complete.
- C. All solvents, unused coatings and cleaning solutions shall be removed from the site and disposed of legally when coating work is complete or if directed by the Project Representative.
- D. Prepare a Waste Disposal Plan to demonstrate all waste material is to be properly disposed; Include:
  - 1. Specify the Contractor is the generator of all waste materials generated by their business activities.
  - 2. Provide details on procedures to be used for properly managing and disposing of waste materials in accordance all applicable laws and regulations.
  - 3. Procedures to document waste types and quantities generated and their disposition.
  - 4. Appoint an employee who is qualified and authorized to enforce proper waste disposal and document the disposal.
- E. Submit completed Waste Disposal Plan and supporting documentation to demonstrate quantities and proper disposal of wastes.

### **3.04 PROTECTION**

- A. Where protection is provided for coated surfaces, such protection shall be preserved in place until the coating film has properly dried, and removal of the protection is authorized by the Project Representative. Items, which have been coated shall not be handled, worked on, or otherwise disturbed, until the coating is completely dry and hard.
- B. Hardware, electrical fixtures, nameplates, shims and similar accessories shall be removed or masked during preparation and coating operations or shall otherwise be satisfactorily protected. Equipment adjacent to walls shall be disconnected and moved to permit cleaning and coating of equipment and walls and, following coating, shall be replaced and reconnected. Any removal or disconnecting of equipment shall be coordinated with the Project Representative.

### **3.05 MANUFACTURER'S SERVICES**

- A. Coating manufacturer's representative shall be present at site as follows:
  - 1. On first day of application of any coating system.

2. A minimum of three, additional site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
3. As required to resolve field problems attributable to or associated with manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

### **3.06 COATING SYSTEMS**

- A. Surfaces to be coated, surfaces not to be coated, coating systems to be used, and required finishes and colors are specified in Section 09901.
- B. Refer to Section 07191 for requirements of water repellent and anti-graffiti coating.

### **3.07 COATING SYSTEM SPECIFICATION SHEET - COATSPEC**

- A. Coating Systems specified for use appear on the following pages. Each of the Coating Systems and their requirements appear on individual pages.



Coating System Identification: A-1	
Coating Material:	High Build Epoxy, 250 g/l max VOC
Surfaces:	Metal
Service Condition:	Immersed, non-potable, corrosive environment.
Surface Preparation:	
Ferrous Metal:	<ol style="list-style-type: none"> <li>1. Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5.</li> <li>2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2. Damaged shop coated areas shall be cleaned in accordance with SSPC SP-11 and recoated with the primer specified. Previously coated surfaces shall be feathered in at the edges.</li> <li>3. Shop primed surfaces shall receive light abrasive blasting prior to application of finish coats.</li> </ol>
Non-Ferrous and Galvanized Metal:	<ol style="list-style-type: none"> <li>1. Non-ferrous and galvanized metal shall be cleaned using a 3,000 PSI minimum, 2.8 GPM minimum, 110F minimum (130F maximum) hot water pressure washer using a new 15 degree or 25 degree fan tip held at 12" or less from the surface. Use a phosphate-free biodegradable cleaner in the wash water such as Simple Green House &amp; Siding Cleaner Pressure Washer Concentrate, Hotsy Enviro-Clean, or Krud Kutter House &amp; Siding Pressure Washer Concentrate. Hard to reach areas shall be cleaned using a solvent wipe or scrubbing with a firm bristle deck brush using 110F minimum wash water mixed with biodegradable cleaner. When the surface is dry, prepare for coating application by providing a SSPC-SP 7, 11, or 16.</li> <li>2. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application.</li> </ol>
Inspection Check Points:	1. Check points 1, 2, 6, 7, 9, 11 and 12.
Application:	Shop or field.
General:	Drying time between coats shall be specified by the manufacturer for the site conditions.
Inspection Check points:	Check points 3 to 5, 7 and 8..
System Thickness:	16 mils dry film minimum.
Level of Containment:	See 1.08.
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Devoe's Bar Rust 236 Multi-Purpose Epoxy
Stripecoat:	One coat of Devoe's Bar Rust 236 Multi-Purpose Epoxy
Intermediate:	One coat of Devoe's Bar Rust 236 Multi-Purpose Epoxy
Finish:	One or more coats of Devoe's Bar Rust 236 Multi-Purpose Epoxy
ALTERNATIVE 2	
Primer:	One coat of Sherwin Williams' Macropoxy 646
Stripecoat:	One coat of Sherwin Williams'. Macropoxy 646
Intermediate:	One coat of Sherwin William's Macropoxy 646
Finish:	One or more coats of Sherwin Williams' Macropoxy 646
ALTERNATIVE 3	
Primer:	One coat of Tnemec's Series V69 Epoxoline.
Stripecoat:	One coat of Tnemec's Series V69 Epoxoline
Intermediate:	One coat of Tnemec's Series V69 Epoxoline
Finish:	One or more coats of Tnemec's Series V69 Epoxoline

Coating System Identification:		A-1
ALTERNATIVE 4		
Primer:	One coat of Carboline Carboguard 890 VOC Epoxy	
Stripecoat:	One coat of Carboline Carboguard 890 VOC Epoxy	
Intermediate:	One coat of Carboline Carboguard 890 VOC Epoxy	
Finish:	One or more coats of Carboline Carboguard 890 VOC Epoxy	
ALTERNATIVE 5		
Primer:	One coat of Ameron's Amerlock 2 VOC	
Stripecoat:	One coat of Ameron's Amerlock 2 VOC	
Intermediate:	One coat of Ameron's Amerlock 2 VOC	
Finish:	One or more coats of Ameron's Amerlock 2 VOC	

Coating System Identification:		A-2
Coating Material:	High Build Epoxy, 250 g/l max VOC.	
Surfaces:	Concrete, masonry, plaster.	
Service Condition:	Immersed, non-potable, corrosive environment.	
Surface Preparation:	<p>For concrete, masonry and plaster.</p> <p>Surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content will be tested by the Contractor and witnessed by the Project Representative. Loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces and voids and cracks shall be repaired per Section 03300. When repair work in Section 03300 is complete, prepare concrete per SSPC SP-13 to ICRI Technical Guideline #310.2-1997. Holes or other joint defects shall be filled with mortar and re-pointed. Loose or splattered mortar shall be removed by scrapping and chipping.</p> <p>Surfaces shall be cleaned with a minimum 5,000 PSI pressure wash using a new turbo nozzle in accordance with SSPC SP-13. Muriatic acid shall not be used. After cleaning, apply skim coat of specified patching mortar to 100% of the surface to repair bugholes, other imperfections and provide a monolithic surface.</p>	
Check Points:	2, 6, 7 and 10 to 12.	
Application:	<ol style="list-style-type: none"><li>1. Field.</li><li>2. Patching mortar shall dry a minimum of 48 hours prior to primer application.</li><li>3. Prime coat shall be applied as recommended by the coating manufacturer, provided the coating as applied, complies with prevailing air pollution control regulations.</li><li>4. Drying time between coats shall be as recommended by coating manufacturer.</li></ol>	
Inspection Check points:	Check points 3 to 5, 7, 8 and 10.	
System Thickness:	16 mils dry film, excluding patching mortar.	
Level of Containment:	See 1.08.	
Coatings:		
ALTERNATIVE 1		
Patching Mortar:	One or more coats of Devoe Devfil 145 Epoxy Filler. Note that epoxy filler shall be applied after application of primer.	
Primer:	One coat of Devoe Pre-Prime 167, applied at 3 mils wet film.	
Finish:	Three or more coats of Devoe Bar Rust 236 Multi-Purpose Epoxy, applied at 5 mils wet film each coat.	
ALTERNATIVE 2		
Patching Mortar:	One or more coats of Sherwin Williams' Dura-Plate 2300.	
Primer:	One coat of Sherwin Williams' Macropoxy 646, applied at 10 mils wet film.	
Finish:	Two or more coats of Sherwin Williams' Macropoxy 646 applied at 10 mils wet film each coat.	
ALTERNATIVE 3		
Patching mortar:	One or more coats of Carboline Carboguard 510 Epoxy Filler.	
Primer:	One coat of Carboline Carboguard 890 VOC Epxoy, applied at 10 mils wet film.	
Finish:	Three or more coats of Carboline Carboguard 890 VOC Epoxy, applied at 5 mils wet film each coat.	

Coating System Identification: A-3	
Coating Material:	Surface Filler and 100% Solids Sprayable Lining System
Surfaces:	Concrete, Masonry, and Miscellaneous Metals.
Service Condition:	Immersed, moderately corrosive environment.
Surface Preparation:	
	Follow Manufacturer's recommendation for crack repair and details at penetrations, construction joints, equipment bolts, anchors, transitions and terminations at edge of system, and other details specific to the structure being coated. The Contractor may use a trowel-applied formulation of the approved lining system if available from the manufacturer.
New:	Surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Concrete and masonry surfaces shall be cleaned with a minimum 5,000 PSI at 3 GPM pressure wash using a new turbo nozzle in accordance with SSPC-SP 13 to ICRI Technical Guideline #03732 CSP 3 minimum profile. Metals shall be prepared to SSPC-SP10 Near White Blast Cleaning.
Existing:	Concrete and masonry surfaces shall be cleaned with a minimum 5,000 PSI at 3 GPM pressure wash using a new turbo nozzle in accordance with SSPC-SP 13 to ICRI Technical Guideline #03732 CSP 5 minimum profile. Metals shall be prepared to SSPC-SP5 White Blast Cleaning.
Inspection Check points:	Check points 2, 6, 7, and 10.
Application:	<ol style="list-style-type: none"> <li>1. Allow patching mortar/surface filler to cure according to manufacturer's instructions prior to coating application.</li> <li>2. Prime coat shall be applied as recommended by the coating manufacturer, provided the coating as applied, complies with prevailing air pollution control regulations.</li> <li>3. Drying time between coats shall be as recommended by coating manufacturer.</li> </ol>
Inspection Check points:	Check points 3-5, 7 and 8.
System Thickness:	125 mils dry film (nominal), excluding patching mortar/surface filler.
Level of Containment:	Refer to 1.08.
Coatings:	
ALTERNATIVE 1	
Patching Mortar/Surface Filler:	Prime as required by manufacturer then apply Epoxytec Mortartec Ceramico, as required to fill bugholes and other surface imperfections.
Sprayable Lining:	Epoxytec CPP Sprayable, 125 mils minimum dry film thickness.
ALTERNATIVE 2	
Patching Mortar/Surface Filler:	Prime as required by manufacturer then apply Quadex QM-1s Restore, as required to fill bugholes and other surface imperfections.
Sprayable Lining:	Quadex Structure Guard, 125 mils dry film thickness.
ALTERNATIVE 3	
Patching Mortar/Surface Filler:	Prime as required by manufacturer then apply Speed Crete PM, Speed Crete Redline, or Approved Equal as required to fill bugholes and other surface imperfections.
Sprayable Lining:	SprayRoq Spraywall, 125 mils dry film thickness.
ALTERNATIVE 4	
Patching Mortar/Surface Filler:	APM Permaform COR+ROC
Sprayable Lining:	APM Permaform COR+ROC, 125 mils dry film thickness.

Coating System Identification:		A-3
ALTERNATIVE 5		
Patching Mortar/Surface Filler:	Prime as required by manufacturer then apply Raven 240 surface filler, as required to fill bugholes and other surface imperfections.	
Sprayable Lining:	Raven AquataFlex 505, 125 mils dry film thickness.	

Coating System Identification: B-1	
Coating Material:	Epoxy, 250 g/l max VOC.
Surfaces:	Metal
Service Condition:	Interior
Surface Preparation:	
Ferrous Metal:	<ol style="list-style-type: none"> <li>1. Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5.</li> <li>2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2. Damaged shop coated areas shall be cleaned in accordance with SSPC SP-11 and recoated with the primer specified. Previously coated surfaces shall be feathered in at the edges.</li> <li>3. Shop primed surfaces shall receive light abrasive blasting prior to application of finish coats.</li> </ol>
Galvanized Metal:	<ol style="list-style-type: none"> <li>1. Galvanized metal shall be cleaned using a 3,000 PSI minimum, 2.8 GPM minimum, 110F minimum (130F maximum) hot water pressure washer using a new 15 degree or 25 degree fan tip held at 12" or less from the surface. Use a phosphate-free biodegradable cleaner in the wash water such as Simple Green House &amp; Siding Cleaner Pressure Washer Concentrate, Hotsy Enviro-Clean, or Krud Kutter House &amp; Siding Pressure Washer Concentrate. Hard to reach areas shall be cleaned using a solvent wipe or scrubbing with a firm bristle deck brush using 110F minimum wash water mixed with biodegradable cleaner. When the surface is dry, prepare for coating application by providing an SSPC-SP 7, 11, or 16.</li> <li>2. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application.</li> </ol>
Non-Ferrous Metal:	Prepare surfaces in accordance with SSPC-SP 7, 11, or 16. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application.
Inspection Check Points:	1. Check points 1, 2, 6, 7, 9, 11 and 12.
Application:	Shop or field.
General:	Drying time between coats shall be specified by the manufacturer for the site conditions.
Inspection Check points:	Check points 3, 4 and 7.
System Thickness:	8 mils dry film minimum.
Level of Containment:	See 1.08.
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Devoe's Bar Rust 233H Epoxy
Stripecoat:	One coat of Devoe's Bar Rust 233H Epoxy
Finish:	One or more coats of Devoe's Bar Rust 233H Epoxy
ALTERNATIVE 2	
Primer:	One coat of Sherwin Williams' Macropoxy 646
Stripecoat:	One coat of Sherwin Williams' Macropoxy 646
Finish:	One or more coats of Sherwin Williams' Macropoxy 646

Coating System Identification:		B-1
ALTERNATIVE 3		
Primer:	One coat of Carboline's Carboguard 890 VOC	
Stripecoat	One coat of Carboline's Carboguard 890 VOC	
Finish:	One or more coats of Carboline's Carboguard 890 VOC	

Coating System Identification		B-2
Coating Material:	Epoxy, 250 g/l max VOC	
Surfaces:	Concrete, masonry, plaster	
Service Condition:	Interior	
Surface Preparation:	<p>For concrete, masonry and plaster</p> <p>Surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content will be tested by the Contractor and witnessed by the Project Representative. Loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces and voids and cracks shall be repaired per Section 03300. When repair work in Section 03300 is complete, prepare concrete per SSPC SP-13 to ICRI Technical Guideline #310.2-1997. Holes or other joint defects shall be filled with mortar and re-pointed. Loose or splattered mortar shall be removed by scrapping and chipping.</p> <p>Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. Muriatic acid shall not be used. After cleaning, apply skim coat of patching mortar specified to 100% of the surface to repair bug holes and other imperfections and provide a monolithic surface.</p>	
Inspection Check Points:	Check points 2, 6, 7 and 10.	
Application:	<ol style="list-style-type: none"><li>1. Field.</li><li>2. Patching mortar shall dry a minimum of 48 hours prior to primer application.</li><li>3. Prime coat shall be thinned and applied as recommended by the coating manufacturer, provided the coating as applied complies with prevailing air pollution control regulations.</li><li>4. Drying time between coats shall be as recommended by coating manufacturer.</li></ol>	
Inspection Check points:	Check points 3,4, and 7..	
System Thickness:	10-12 mils dry film, excluding patching mortar.	
Level of Containment:	See 1.08.	
Coatings:		
ALTERNATIVE 1		
Patching Mortar:	One or more coats of Devco Devfil 145 Epoxy Filler. Note that epoxy filler shall be applied after application of primer	
Primer:	One coat of Devco's Bar Rust 233H Low VOC Epoxy applied at 5 mils wet film	
Finish:	One or more coats of Devco's Bar Rust 233H Low VOC Epoxy, applied at 5 mils wet film each coat	
ALTERNATIVE 2		
Patching Mortar:	One or more coats of Sherwin Williams' Steel Dura-Plate 2300.	
Primer:	One coat of Sherwin Williams' Macropoxy 646 applied at 10 mils wet film	
Finish:	One or more coats of Sherwin Williams' Macropoxy 646 applied at 10 mils wet film each coat	
ALTERNATIVE 3		
Patching Mortar:	One or more coats of Carboline's Carboguard 510	
Primer:	One coat of Carboline's Carboguard 890 VOC applied at 5 mils wet film.	
Finish:	One or more coats of Carboline's Carboguard 890 VOC applied at 5 mils wet film each coat.	



Coating System Identification: B-3	
Coating Material:	Epoxy
Surfaces:	Aluminum
Service Condition:	Interior, exterior, where aluminum is in contact with concrete or dissimilar metals
Surface Preparation:	Surface preparation for nonferrous and galvanized metal shall include a pressure wash with a cleaning solution recommended by the coating manufacturer, mixed with 160-degree water and applied at 2500 psi. Rinse with 160 degree water 2500 psi. When the surface is dry, prepare for coating application by providing a SSPC SP-7. See Preparation paragraph within this Section for alternative methods.
Inspection Check points:	Check points 2 to 4, 6 and 7.
Application:	Shop or field.
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Devoe's Devran 203 WB Epoxy, 2 to 3 mils dry film.
Coating:	One coat of Devoe's Bar Rust 236 Multi-Purpose Epoxy, 6 to 8 mils dry film thickness.
ALTERNATIVE 2	
Primer:	One coat of Carboline Carboguard 60 Epoxy, 2 to 3 mils dry film.
Coating:	One coat of Carboline Carboguard 890 VOC, 4 to 6 mils dry film.

Coating System Identification:		B-4
Coating Material:	Fusion Bonded Epoxy	
Surfaces:	Steel Dowels	
Service Condition:	Steel expansion dowels embedded in concrete.	
Surface Preparation:	SSPC SP-10	
Application:	Shop	
General:	TFE lube shall be shop applied. Grease lube alternative shall be field applied just prior to installation.	
System Thickness:	7 mils dry film, minimum for fusion-bonded epoxy. Apply one coat of TFE lube or grease lube, as required to provide a slip surface.	
Coatings:		
ALTERNATIVE 1		
Coating:	3M Skotchkote 413, 1 or 2 coats. DuPont NapGuard 7-2719, 1 or 2 coats.	
Lube:	TFE liquid coating compatible with fusion bonded epoxy. RL 736 manufactured by Amrep, Inc., Marietta, GA.	

Coating Systems Identification: C-1	
Coating Material:	Epoxy primer, polyurethane finish, color required.
Surface:	Metal
Service Condition:	Non-immersed, exposure to moisture and sunlight, color required.
Surface Preparation:	
Ferrous Metal:	<ol style="list-style-type: none"> <li>1. Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5.</li> <li>2. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2. Damaged shop coated areas shall be cleaned in accordance with SSPC SP-11 and recoated with the primer specified. Previously coated surfaces shall be feathered in at the edges.</li> <li>3. Shop primed surfaces shall receive light abrasive blasting prior to application of finish coats.</li> </ol>
Nonferrous and Galvanized Metal:	Nonferrous and galvanized metals shall be cleaned using a 3,000 PSI minimum, 2.8 GPM minimum, 110F minimum (130F maximum) hot water pressure washer using a new 15 degree or 25 degree fan tip held at 12" or less from the surface. Use a phosphate-free biodegradable cleaner in the wash water such as Simple Green House & Siding Cleaner Pressure Washer Concentrate, Hotsy Enviro-Clean, or Krud Kutter House & Siding Pressure Washer Concentrate. Hard to reach areas shall be cleaned using a solvent wipe or scrubbing with a firm bristle deck brush using 110F minimum wash water mixed with biodegradable cleaner. When the surface is dry, prepare for coating application by providing an SSPC-SP 7, 11, or 16.. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application.
Inspection Check Points:	Check points 1, 2, 6, 7, 11 and 12.
Application:	Shop or field.
General:	Drying time between coats shall be as specified by the manufacturer for the site conditions.
Inspection Check points:	Check points 3, 4, and 7..
System Thickness:	8 mils dry film, minimum.
Level of Containment:	See 1.08.
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of Devoe 203 VOC Epoxy.
Finish:	One or more coats of Devoe Devthane 379H Polyurethane.
ALTERNATIVE 2	
Primer:	One coat of Sherwin Williams' Macropoxy 646.
Finish:	One or more coats of Sherwin Williams' Hi-Solids Polyurethane.
ALTERNATIVE 3	
Primer:	One coat of Carboline Carboguard 635 VOC Epoxy..
Finish:	One or more coats of Carboline Carbothane 8845 Polyurethane.

Coating Systems Identification: C-3	
Coating Material:	Modified Epoxy
Surfaces:	Concrete, secondary containment: all vertical and horizontal surfaces within the containment area including sumps and trenches and the top of the containment wall; concrete exposed to chemical leakage; pipe trenches and equipment pads associated with conveying the chemicals listed below.
Service Condition:	Chemical stored in containment or conveyed are: sodium hydroxide (25% concentration) and aluminum chlorohydrate (43% concentration). .
Surface Preparation:	For concrete, masonry and plaster.  Allow new concrete and mortar to cure 28 days. Abrasive blast or mechanically abrade concrete to remove laitance, form release agents, curing compounds, hardeners, sealers, dirt, oil and other contaminants. Surfaces must be clean, dry and sound. Voids and cracks shall be repaired per Section 03300. When repair work in Section 03300 is complete, prepare concrete per SSPC SP-13 to ICRI Technical Guideline #310.2-1997. Following surface cleaning, apply skim coat of water-based cementitious patching mortar to entire surface to repair bug holes and other imperfections.
General:	Provide letter from manufacturer stating that the installer has notified the manufacturer of proposed installation and that manufacturer is in agreement with the intended application.  Follow Manufacturer's recommendation for crack repair and details at floor penetrations, wall bases, construction joints, equipment bolts, metal angle frames at trenches, transitions and terminations at edge of system, and other details specific to the structure being coated.
Inspection Check Points:	Check points 1, 2, 6, 7 and 10.
Application:	<ol style="list-style-type: none"> <li>1. Field.</li> <li>2. Patching, mortar shall dry a minimum of 48 hours prior to primer application.</li> <li>3. Prime coat shall be thinned and applied as recommended by the coating manufacturer, provided the coating as applied complies with prevailing air pollution control regulations.</li> <li>4. Drying time between coats shall be as recommended by coating manufacturer.</li> <li>5. Extend coating completely under tanks, structures and equipment.</li> <li>6. Provide continuous sealant, backing material, and joint-lining treatment recommended by the coating manufacturer at all expansion, isolation, and construction joints.</li> <li>7. Coat over equipment anchors and base plates installed in areas receiving coating to maintain continuous liquid-tight seal. Provide written instructions for treatment of penetrations.</li> <li>8. Provide nonskid finish in containment areas and coated walkway surfaces as indicated. Apply aggregate when intermediate coat is wet and remove excess aggregate after intermediate coat dries, prior to application of finish.</li> </ol>
Inspection Check points:	Check points 3, 4, 5, 7, and 8..
System Thickness:	As specified for the approved Alternative.
Coatings:	

Coating Systems Identification: C-3	
ALTERNATIVE 1	
Patching Mortar:	Coating manufacturer's recommendation.
Primer:	One coat of Sherwin Williams Corobond 100 Epoxy Primer/Sealer, 4 to 6 mils dry film thickness.
Filler/Surfacer:	Sherwin Williams Steel Seam FT910, as needed.
First Coat:	One coat of Sherwin Williams Cor-Cote HCR FF Flake Filled Novolac Epoxy, 15 to 20 mils dry film thickness.
Intermediate Coat:	One coat of Sherwin Williams Cor-Cote HCR FF Flake Filled Novolac Epoxy, 15 to 20 mils dry film thickness.
Aggregate Fill:	20/40 mesh aluminum oxide, per manufacturer's recommendation, applied to refusal.
Finish:	One coat of Sherwin Williams Cor-Cote HCR FF Flake Filled Novolac Epoxy, 10 to 12 mils dry film thickness.
ALTERNATIVE 2	
Patching Mortar:	Coating manufacturer's recommendation.
Primer:	One coat of Carboline Semstone 110, 5 to 6 mils dry film thickness.
	<u>Vertical Surfaces</u>
Filler/Surfacer:	Carboline Semstone 110 blended with silica and thixotrope per manufacturer's directions; as needed
Finish:	One coat of Carboline Semstone 145 blended with silica and thixotrope per manufacturer's directions, 30 to 40 mils dry film thickness.
	<u>Horizontal Surfaces</u>
Base Coat:	One coat of Carboline Semstone 145, 60 to 75 mils dry film thickness per coat.
Aggregate Fill:	20/40 mesh silica aggregate, per manufacturer's recommendation, 1.5 pounds per square foot.
Finish:	One coat of Carboline Semstone 145, 15 to 20 mils dry film thickness.

Coating System Identification: H-1	
Coating Material:	Modified epoxy, or approved equivalent.
Surface:	Metal
Service Condition:	Temperature to 600 degrees F, continuous
Surface Preparation:	Metal surfaces shall be prepared in accordance with SSPC SP-10 (Near White Metal Blast Cleaning).
Inspection Check points:	Check points 1, 2, 3, 4, apply.
Application:	1. Field 2. Curing as required by coating manufacturer.
Coatings:	
ALTERNATIVE 1	
System Thickness:	Three coats of International Intertherm 50
ALTERNATIVE 2	
	Two coats of Sherwin Williams KEM HI-TEMP HEAT-FLEX II 450.Sherwi

Coating System Identification:		J-1
Coating Material:	Water-based Semi-gloss enamel.	
Surfaces:	Concrete or masonry.	
Surface Preparation:		
Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content will be tested by the Contractor and witnessed by the Project Representative per ASTM D4263, or approved equal. Loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by sandblasting and chipping, voids and cracks shall be repaired per Section 03300. When repair work in Section 03300 is complete, prepare the concrete per SSPC SP-13 to ICRI Technical Guideline #310.2-1997.	
Masonry:	<ol style="list-style-type: none"><li>1. Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and re-pointed. Loose or splattered mortar shall be removed by scraping and chipping.</li><li>2. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.</li><li>3. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be cleaned and filled with block filler compatible with the specified primer. Sealer shall be applied as recommended by the coating manufacturer.</li></ol>	
Application:	<ol style="list-style-type: none"><li>1. Field.</li><li>2. Sealer or filler shall dry a minimum of 48 hours prior to application of prime coat.</li><li>3. Prime coat shall be thinned and applied as recommended by the coating manufacturer, provided the coating as applied complies with prevailing air pollution control regulations.</li></ol>	
Inspection Check points:	Check points 1 through 10 apply.	
System Thickness:	5 mils dry film, minimum. Primer coat shall be 4 mils wet film. Finish coat shall be 3.5 mils wet film each coat.	
Coatings:		
ALTERNATIVE 1		
Primer:	One coat of ICI Paints' 3210 – 1200 Ultrahide Gripper Acrylic.	
Finish:	Two coats of ICI Paint's Dulux 1506 Advanced Alkyd WB Semigloss Enamel.	
ALTERNATIVE 2		
Primer:	One coat of Rodda's 501601 Acrylic Primer	
Finish:	Two coats of Rodda's 548901 Metal Master DTM Enamel.	
ALTERNATIVE 3		
Primer:	One coat of Sherwin Williams' Loxon Conditioner A24-100.	
Finish:	One or more coats Sherwin Williams' DTM Alkyd Enamel B55.	
ALTERNATIVE 4		
Primer:	One coat of Tnemec's Series 27 WB Typoxy	
Finish:	Two coats Tnemec's Series 1029 Enduratone	

Coating System Identification: J-2	
Coating Material:	Water-based Semi-gloss enamel.
Surfaces:	<ol style="list-style-type: none"> <li>1. All exposed surfaces of cast iron and steel piping inside buildings or tunnels and above grade outdoors, including valves, fittings, flanges, bolts, supports and accessories therefore, and including galvanized surfaces after proper priming.</li> <li>2. All exposed surfaces of electrical conduit inside buildings (except banks of conduits in multiple layers hung from ceilings), including fittings, boxes, supports, and accessories therefore, after proper priming.</li> </ol>
Service Condition:	Interior/Exterior Metal
Surface Preparation:	
Ferrous Metal:	<ol style="list-style-type: none"> <li>1. Ferrous metal surfaces shall be prepared in accordance with SSPC SP-10.</li> <li>2. All shop-primed surfaces, which are to be incorporated into the work shall be inspected in the field by the Project Representative prior to all surface preparation. Damaged shop coating and ferrous metal with bleeding surfaces shall receive a SSPC SP-7 and recoated with specified primer prior to the application of finish coats.</li> </ol>
Non-Ferrous and Galvanized Metal:	<ol style="list-style-type: none"> <li>1. Surface preparation for non-ferrous and galvanized metal shall include a pressure wash with a cleaning solution recommended by the coating manufacturer, mixed with 160-degree water and applied at 2500 psi. Rinse with 160-degree water, 2500 psi. When the surface is dry, prepare for coating application by providing a SSPC SP-7. Alternative surface preparation methods shall be per the manufacturer's written direction for profile and surface cleanliness for the given application.</li> </ol>
Application:	Shop or field. Shop-applied coat shall be a minimum of 3 dry mils or 1 mil, above the maximum blast profile, whichever is greater.
General:	Drying time between coats shall be as specified by the manufacturer for the site conditions.
Ferrous, Nonferrous and Galvanized Metal:	Prime coat shall be the primers specified.
Inspection Check points:	Check points 1 through 9 apply.
System Thickness:	5 mils dry film, minimum.
Level of Containment:	See 1.08.
Coatings:	
ALTERNATIVE 1	
Primer:	One coat of ICI Paints' Devran 203 Galvanized Metal Primer
Finish:	One or more coats of ICI Paints' Dulux 1506 Advanced Alkyd WB Semi-Gloss Enamel.
ALTERNATIVE 2	
Primer:	One coat of Sherwin Williams' Kem Kromik Universal Metal Primer.
Finish:	One or more coats of Sherwin Williams' DTM Alkyd Enamel B55.
ALTERNATIVE 3	
Primer:	One coat of Tnemec's Series 27 WB Typoxy Primer.
Finish:	One or more coats of Tnemec's Series 1029 Enduratone.
ALTERNATIVE 4	
Primer:	One coat of Rodda's 70329 Ecologic Rustex Primer
Finish:	One coat of Rodda's 548901 Metal Master DTM Enamel



Coating System Identification:		J-3
Coating Material:	Water reducible epoxy.	
Surfaces:	Concrete floors, interior.	
Service Condition:	Traffic area, some standing water.	
Surface Preparation:		
New Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested by the Contractor and witnessed by the Project Representative in accordance with ASTM D4263, or approved equal. Loose concrete, form oils, surface hardeners, curing compounds and laitance shall be removed. Surface shall be cleaned by steam cleaning and abraded with a "blastrac". Voids and cracks shall be repaired.	
Existing Concrete:	Loose concrete, form oils, surface hardeners, curing compounds and laitance shall be removed. Surface shall be cleaned by steam cleaning and abraded with a "blastrac". Voids and cracks shall be repaired.	
Application:	Field.	
General:	Follow manufacturer's instructions for mixing and "sweat-in" time.	
Inspection Check points:	Check points 1 through 10 apply.	
System Thickness:	Two coats at 5 mils wet film each.	
Color:	West Division shall be clear.	
Coatings:		
ALTERNATIVE 1		
	Two coats of International 4426/4428 TruGlaze WB Epoxy or two coats of PPG Aquapon WB Epoxy.	
ALTERNATIVE 2		
	Two coats of Rust-Oleum Sierra S40 Epoxy	
ALTERNATIVE 3		
	Two coats of Carboline's Sanitile 555	

Coating System Identification: J-4	
Coating Material:	Water-Based Acrylic Sealer
Surfaces:	Concrete walls, interior.
Service Condition:	Dry, noncorrosive spaces.
Surface Preparation:	
New Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested by the Contractor and witnessed by the Project Representative in accordance with ASTM D4263, or Approved Equal. Loose concrete, form oils, surface hardeners, curing compounds and laitance shall be removed by steam cleaning with abrasive blasting. Voids and cracks shall be repaired as specified in Section 03300.
Existing Concrete:	Loose concrete, form oils, surface hardeners, curing compounds and laitance shall be removed. Surface shall be cleaned by steam cleaning and abraded with a "blastrac". Voids and cracks shall be repaired.
Application:	Field. Spray-apply.
General:	Follow manufacturer's instructions.
Inspection Check points:	Check points 1 through 10 apply.
System Thickness:	Two coats at 5 mils wet film each.
Color:	West Division shall be clear.
Coatings:	
ALTERNATIVE 1	
	Two coats, Scofield Systems CEMENTONE Clear Sealer.
ALTERNATIVE 2	
	Or Approved Equal as approved by the Project Representative.

Coating System Identification: J-5	
Coating Material:	Clear wood sealer
Surfaces:	Wood walls, interior.
Service Condition:	Dry, noncorrosive spaces.
Surface Preparation:	Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application . Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
New Wood Surface:	
Existing Wood Surface:	
Application:	Follow manufacturer's instructions.
General:	Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be stained. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and staining. After completing staining operations, reinstall items removed using workers skilled in trades involved.
Inspection Check points:	
System Thickness:	
Color:	Clear
Coatings:	
ALTERNATIVE 1	
	Three coats Osmo Polyx-Oil High Solid
ALTERNATIVE 2	
	Three coats Osmo Polyx Professional Hardwax-Oil
ALTERNATIVE 3	
	Three coats Dalys Profin Satin

Coating System Identification: J-6	
Coating Material:	Opaque Finish Latex System
Surfaces:	Plywood walls, interior.
Service Condition:	Dry, noncorrosive spaces.
Surface Preparation:	Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application . Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
New Wood Surface:	
Existing Wood Surface:	N/A
Application:	Use on plywood surface indicated to receive opaque paint per manufacturer's instructions.
General:	
Inspection Check points:	
System Thickness:	
Color:	PT-51 per Section 09901 and drawings.
Coatings:	Three coats; first coat latex wood primer, and second and third coat latex enamel.
ALTERNATIVE 1	
	Sherwin-Williams: Primer: Harmony Primer 0 VOC B11W900. Finish: Pro Classic Waterborne Semi-gloss dft 157 g/l VOC
ALTERNATIVE 2	
	Benjamin Moore Paint Company: Primer: Ultraspec 500 Interior Latex Primer N534. Finish: Ultraspec 500 Interior Semi-gloss N539.

Coating System Identification:		J-7
Coating Material:	Anti-Graffiti Coating	
Surfaces:	Expanded Metal Fence	
Service Condition:	Outdoors, Atmospheric.	
Surface Preparation:		
Galvanized Steel, Expanded Metal Fabric	Clean using a 3,000 PSI minimum, 2.8 GPM minimum, 110F minimum (130F maximum) hot water pressure washer using a new 15 degree or 25 degree fan tip held at 12” or less from the surface. Use a phosphate-free biodegradable cleaner in the wash water such as Simple Green House & Siding Cleaner Pressure Washer Concentrate, Hotsy Enviro-Clean, or Krud Kutter House & Siding Pressure Washer Concentrate. Hard to reach areas shall be cleaned using a solvent wipe or scrubbing with a firm bristle deck brush using 110F minimum wash water mixed with biodegradable cleaner.	
Galvanized Steel, Structural Components (Posts, Rails, etc.)	After cleaning as specified above, allow surfaces to dry and prepare for coating application by providing an SSPC-SP 7, 11, or 16.  Alternative surface preparation methods shall be per the manufacturer’s written direction for profile and surface cleanliness for the given application.	
Application:	Shop or Field.	
General:	Follow manufacturer's instructions.	
Inspection Check points:	Checkpoints 6, 7, 11, and 12 apply.	
System Thickness:	See below.	
Color:	As specified.	
Coatings:		
ALTERNATIVE 1		
	1 coat Sherwin Williams DTM Wash Primer, 0.7 to 1.3 mils dry film thickness (do not exceed manufacturer’s recommended maximum thickness). 1 coat Sherwin Williams SherCryl HPA, 2.5 to 4 mils dry film thickness. 1 coat Sherwin Williams Anti-Graffiti Coating, 1K Siloxane, 6 to 9 mils dry film thickness.	
ALTERNATIVE 2		
	Approved equal.	

Coating System Identification: L-1	
Coating Material:	Latex semi-gloss enamel.
Surfaces:	Concrete, masonry, plaster, gypsum board.
Surface Preparation:	
Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested by the Contractor and witnessed by the Project Representative per ASTM D4263, or approved equal. Loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by sandblasting and chipping, and voids and cracks shall be repaired.
Masonry:	<ol style="list-style-type: none"> <li>1. Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scrapping and chipping.</li> <li>2. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.</li> <li>3. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be cleaned and filled with block filler compatible with the specified primer.</li> </ol>
Plaster:	Plaster surfaces shall be dry and clean and free from grit, loose plaster and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. After cleaning, surfaces shall be sealed with a compatible sealer.
Gypsum Wallboard:	Tape joints and spackled nail heads shall be sanded smooth and dusted. Seal with PVA sealer.
Inspection Check Points:	Check points 6, 7, 10
Application:	Field. Sealer or filler shall dry a minimum of 48 hours prior to primer application. Drying time between coats shall be as recommended by the coating manufacturer.
Inspection Check points;	Check points 6 and 7..
System Thickness:	4 mils dry film, minimum. 6 mils wet film each coat. Wet mils shall be for un-thinned material.
Coatings:	
Color:	See Section 09901.
ALTERNATE 1	
Primer:	One coat of Columbia's 00-028-PP Alkali Resistant Primer for concrete, block and plaster.
Finish:	Two coats of Columbia's 02-752-WB Interior Acrylic Semi-Gloss.
ALTERNATE 2	
Primer:	One coat of ICI Paints' 3210 – 1200 Ultrahide Gripper Acrylic Sealer.
Finish:	Two coats of ICI Paints' 1416 Ultrahide Acrylic Semi-Gloss Latex Enamel.
ALTERNATE 3	
Primer:	One coat of Sherwin Williams' PrepRite 200 Wall Primer B28 W200.
Finish:	Two coats of Sherwin Williams' Pro Mar 200 Latex Semi-Gloss B31 W200.
ALTERNATE 4	
Primer:	One coat of Tnemec's Series 29 Tufcrl.
Finish:	Two coats of Tnemec's Series 29 Tufcrl.

Coating System Identification: L-2	
Coating Material:	Elastomeric or approved equivalent.
Surfaces:	Concrete, masonry or plaster.
Service Condition:	Exterior, non-immersion, severe service, salt air.
Surface Preparation:	
Concrete:	Concrete surfaces shall be allowed to age for at least 28 days and allowed to dry to the moisture content recommended by the coating manufacturer. Moisture content shall be tested by the Contractor and witnessed by the Project Representative per ASTM 4263, or approved equal. Loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by sandblasting and chipping, and voids and cracks shall be repaired.
Masonry:	<ol style="list-style-type: none"> <li>1. Masonry surfaces shall be allowed to age for at least 28 days. Holes or other joint defects shall be filled with mortar and repointed. Loose or splattered mortar shall be removed by scrapping and chipping.</li> <li>2. Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.</li> <li>3. Muriatic acid shall not be used. After cleaning, masonry surfaces shall be cleaned and filled with block filler compatible with the specified primer.</li> </ol>
Plaster:	Plaster surfaces shall be dry and clean and free from grit, loose plaster and surface irregularities. Cracks and holes shall be repaired with acceptable patching materials, keyed to existing surfaces, and sandpapered smooth. Surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances. After cleaning, surfaces shall be sealed with a compatible sealer.
Inspection Check points:	Check points 1 through 10 apply.
Application:	<ol style="list-style-type: none"> <li>1. Field.</li> <li>2. Sealer or filler shall dry a minimum of 48 hours prior to primer application.</li> <li>3. Drying time between coats shall be as recommended by the coating manufacturer.</li> </ol>
Coatings:	
ALTERNATE 1	
Primer:	One coat of ICI Paints' 3210-1200 Prep and Prime Acrylic Sealer, applied at 3 mils wet film.
Finish:	Two coats of ICI Paints' 2260 DecraFlex Elastomeric applied at 16 mils wet film each coat.
ALTERNATE 2	
Primer:	One coat of Kelly Moore's KM 247 Acry-Shield 100% Acrylic applied at 4 mils wet film thickness
Finish:	Two coats of Kelly Moore's KM 1128 Kel-Seal Acrylic Terpolymer applied at 8-10 mils wet film thickness each coat
ALTERNATE 3	
Primer:	One coat of Rodda's 501801 Surfbond II Masonry Conditioner applied at 2-3 mils wet film thickness
Finish:	Two coats of Rodda's 511301 Super Roflex Elastomeric applied at 15 mils wet film each coat.

Coating System Identification:		P-1
Coating Material:	Acrylic latex, semi-gloss enamel.	
Surfaces:	PVC, CPVC, Miscellaneous Plastic.	
Service Condition:	Interior/Exterior.	
Surface Preparation:	As specified.	
Application:	Field	
Inspection Check points:	Check points 6,7 and 8 apply.	
Coatings:		
ALTERNATE 1		
Primer:	One coat ICI Devoe 3210 Ultrahide Gripper Acrylic Sealer.	
Finish:	One or more coats of ICI Devoe 4216 High Performance Waterborne Acrylic Semi-Gloss Enamel.	
ALTERNATE 2		
Primer:	One coat of Tnemec Series 1029 Enduratone.	
Finish:	One or more coats of Tnemec Series 1029 Enduratone.	
ALTERNATE 3		
Primer:	One coat of Sherwin Williams DTM Acrylic Primer/Finish B66 Series.	
Finish:	One or more coats of Sherwin Williams Sher-Cryl HPA High Performance Semi-Gloss Acrylic B66 Series.	

### 3.08 COLOR SCHEDULE

- A. Provide paint colors to match those indicated on the drawings and in Section 09901. Where a paint color is listed from a specific manufacturer, paint products from other approved manufacturers may be used, provided the color exactly matches the specified color, and the paint system meets the specified requirements. Where no paint color is indicated, provide color and sheen as selected by the Project Representative.

**END OF SECTION**



**SECTION 09901**  
**FINISH SCHEDULE**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies finishes and colors for rooms, equipment and other items which are to be painted, coated, or have other architectural finishes.

**1.02 QUALITY ASSURANCE**

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
	Federal Standard 595 Paint Specification

- B. General: Unless otherwise specified, all materials and workmanship shall conform to the applicable requirements of Section 09900.
- C. The Project Representative reserves the right to reselect any color, from the manufactures full range of available colors, during the submittal process. In case of conflict between requirements of this Section and the specified or listed documents, the requirements of this section shall prevail.

**1.03 SUBMITTALS (NOT USED)**

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. In the following schedule, the coating system for each specified surface shall comply with those listed in COATSPEC, Section 09900. Coat surfaces indicated on this schedule unless specifically indicated in the Drawings or in the Specifications. In the case of conflict, the Room Finish Schedule shall take precedence over the Finish Schedule tables included in this Section.
1. If not specified otherwise, color reference numbers are from the Federal Standard 595 Paint Spec
- B. Special Equipment Colors: Paint equipment and piping as indicated, except as itemized below:
1. Fire Protection Equipment, Pipes and Apparatus: OSHA Red.
  2. Physical hazards in normal operating area and energy lockout devices, included but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.
- C. Electrical conduit is not painted if coated with PVC or specifically indicated otherwise in the Drawings or in the Specifications.

### 3.02 FINISH SCHEDULE

A. See Drawings and Room Finish Schedule for locations.

Mark	Manufacturer	Color	Finish
PT-51	Sherwin Williams	SW 7064 PASSIVE	EGGSHELL
PT-52	Sherwin Williams	SW 7064 PASSIVE	FLAT
PT-53	Sherwin Williams	SW 7064 PASSIVE	SEMI-GLOSS
PT-54	Sherwin Williams	SW 2849 WESTCHESTER GRAY	SEMI-GLOSS
PT-55	Sherwin Williams	SW 7069 IRON ORE	SEMI-GLOSS
PT-56	Sherwin Williams	SW 6991 BLACK MAGIC	FLAT
PT-57	Sherwin Williams	SW 7006 EXTRA WHITE	FLAT
PT-58	Sherwin Williams	SW 7018 / DOVETAIL	EGGSHELL
PT-59	Tnemec Company	1072D6247 Fluoronar Sat B Beauty/Obsidia (Black)	FLAT
PT-60	Tnemec Company	Winter Mist 07WH	FLAT
PT-61	Federal Standard	35250	FLAT
PT-62	Tnemec Company	59BL Seaspray	FLAT
PT-63	Tnemec Company	05BL Gainesboro	FLAT

B. Finish schedule excludes interior finishes for 900 Operations and Maintenance Building. See 3.02 A of this section and other relevant specifications.

Surfaces	Coating System	Color
Submerged metals	A-1	West Division:# 36495
Submerged concrete, where shown or specified	A-2	West Division:# 36495
Interior, exposed metal, wet environments	B-1	PT-59
Exterior exposed metals, including equipment, exposed conduit, piping, valves, and appurtenances; utilities; handrails; roof flashing; exterior doors	C-1	PT-59
Exterior exposed undersides of metal decking and metal panel.	C-1	Either PT-61, PT-62, or PT-63. Color to be selected by Project Representative based on mockup described in Section 09900.
Interior, exposed metal decking in damp and humid environments	B-1	PT-60
Concrete, secondary containment.	C-3	Concrete Gray
Metal exhaust manifold, exhaust piping	H-1	PT-59
Concrete or masonry, indoor dry	J-1	Concrete Gray
Interior miscellaneous metals, including equipment, piping and appurtenances, pipes attached to equipment,	J-2	PT-59
Interior concrete floor exposed to traffic and some standing water	J-3	Clear coat or as indicated in drawings
Interior plywood walls	J-6	PT-51
Interior concrete, masonry, plaster	L-1	Clear coat or as indicated in drawings
Exterior concrete, masonry, plaster	L-2	Clear coat or as indicated in drawings
Exterior PVC and CPVC pipe and fittings	P-1	PT-59

Surfaces	Coating System	Color
Interior PVC and CPVC pipe and fittings	P-1	West Division:# 36495
Exposed conduit, boxes, and miscellaneous appurtenances	J-2	Match adjacent wall
Equipment or metal items provided without factory finish – indoor, dry	J-2	PT-59
Equipment or metal items provided without factory finish – indoors wet, process corrosive	B-1	PT-59
Equipment or metal items provided without factory finish – chemical corrosive, head space	A-1	PT-59
Equipment or metal items provided without factory finish – outdoors	C-1	PT-59
Aluminum, including flashings, doors, louvers, frames, and site accessories	Anodize	As specified in Section 08400.

For Special Equipment Colors see 3.01B.

- C. Where coating systems are not specifically referenced in the above table for specific exposed metal items, use the coating system specified below for the exposure condition. See Section 01450 for definitions and locations of environments listed below.

Exposure Condition	Coating System
Outdoor	C-1
Indoor, Dry	J-2
Indoor, Wet	B-1
Process Corrosive	B-1
Chemical Corrosive	A-1
Head Space	A-1
Submerged	A-1

**END OF SECTION**

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## DIVISION 10

### SPECIALTIES

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## SECTION 10001

### FALL PROTECTION EQUIPMENT

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies: Design, fabrication, and installation of the following:
  - 1. Fall protection equipment at roofing assemblies.
- B. System Description:
  - 1. Design system to comply with the following fall arrest system (FAS) requirements:
    - a. Limit maximum arresting force on a user /employee to 1800 lbs maximum arrest force (MAF) when used with a body harness.
    - b. Rigged such that a user/employee can neither free fall more than 6'-0" nor contact any lower level.
    - c. End and intermediate anchors to resist a 5,000 lb. horizontal load in any direction without detachment or fracture occurring. This load is considered to be an ultimate peak dynamic load and yielding of the anchor and structure in the event of a fall is not precluded. To avoid deformation under normal usage, anchors are to be generally designed to resist a 1,000 lb. static horizontal load in any direction without yielding.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
AWS	American Welding Society

- B. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 10 years.
  - 1. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.
- C. Welding: In conformance with AWS D1.1.

##### 1.03 SUBMITTALS

- A. Shop drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations, and large scale details of typical sections and connections.
- B. Certificates: Submit certification signed and sealed by a Professional Structural Engineer registered in the state of Washington that system has been designed to meet specified performance requirements.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER**

- A. Basis-of-Design:
  - 1. The design of the fall arrest equipment is based on SSRA1 Mill Finish "Standing Seam Roof Anchor" by Fall Protection Distributors, LLC. Subject to compliance with requirements, provide systems of named manufacturer or a comparable product.
  - 2. Bolts, nuts and washers: Type 304 stainless steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

### **3.02 INSTALLATION**

- A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the Work.
- B. Co-ordinate installation with work of related trades.
- C. Anchor metal fabrications to substrates indicated; provide all fasteners required.
- D. Install items in correct location, plumb and level, without rack or warp.
- E. Provide temporary supports and bracing as required.

### **3.03 ADJUSTING**

- A. Final Adjustments: Upon achieving substantial completion of the work, adjust all operable components to ensure that they are properly installed and functioning smoothly. Replace any component which cannot be adjusted for proper operation.

**END OF SECTION**



**SECTION 10101**  
**VISUAL DISPLAY SURFACES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies glass marker boards.

**1.02 QUALITY ASSURANCE (NOT USED)**

**1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product Data.
- C. Shop drawings: Show each panel configuration; show panel thickness and perimeter frame and chalk tray details. Include provisions for mounting.

**PART 2 PRODUCTS**

**2.01 GLASS MARKER BOARD (GP-51)**

- A. Description: Frameless, non-ghosting, glass marker boards.
- B. Acceptable manufacturers:
  - 1. Skyline Design.
  - 2. Clarus Glass Boards.
  - 3. Egan Visual Inc.
  - 4. Gardener Glass Products.
  - 5. Approved Equal.
- C. Materials:
  - 1. Low-iron safety glass with manufacturer's flood coat on number 2 surface.
    - a. Color: Match Skyline Design Vitracolor 2014-02
  - 2. Manufacturer's recommended adhesive.
- D. Sizes: As indicated in the Drawings.
- E. Furnish two erasers per board and minimum of 24 dry erase pens.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Coordinate placement of metal backing at metal framing to support components.
- B. Provide additional reinforcements and framing to wall structure as necessary for a secure and stable installation.

### **3.02 INSTALLATION**

- A. Install components in accordance with the manufacturer's recommendations in the locations indicated and scheduled.
- B. Provide all accessories and fasteners as necessary for a complete installation.

**END OF SECTION**

## SECTION 10200

### LOUVERS AND VENTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies architectural louvers and blank-off panels.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
American Architectural Manufacturers Association (AAMA) 2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
Air Movement and Control Association (AMCA) 500-L AMCA 511	Laboratory Methods for Testing Louvers for Rating  Certified Ratings Program Product Rating Manual for Air Control Devices
ASTM International (ASTM) B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Shop drawings:
1. Drawing showing location of each louver or vent, indicating size and arrangement of blank-off plates if required.
  2. Product technical data including:
    - a. Acknowledgement that products submitted meet requirements of standards referenced.
    - b. Manufacturer's installation instructions.
    - c. Color chart showing manufacturer's full line of colors including exotic and special colors for color selection by Project Representative.
  3. Samples:
    - a. Samples of factory applied high performance organic coatings of colors.
      - 1) Provide actual metal samples (aluminum).
      - 2) Color cards and computer generated color reproductions are not acceptable.

##### 1.04 WARRANTY

- A. Factory applied high performance organic coatings utilizing PVDF resins shall be provided with manufacturer's standard 10 year warranty against color fade, chalking and film integrity.

## **PART 2 PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Airolite Co.
- B. Construction Specialties, Inc.
- C. Ruskin Manufacturing.
- D. Industrial Louvers, Inc.
- E. American Warming.
- F. Approved Equal.

### **2.02 MANUFACTURED UNITS**

- A. Louvers:
  - 1. 4 inch deep.
  - 2. Drainable with blades at 37-1/2 degrees.
  - 3. Continuous blade appearance.
  - 4. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 inch thick.
  - 5. Minimum free area: 8.58 square feet for 4 x 4 ft louver.
  - 6. Maximum pressure drop: 0.10 inches of water at 700 fpm.
  - 7. Water penetration: 0.01 ounces/sf at 873 fpm.
  - 8. AMCA certified for water penetration and air performance.
  - 9. Ruskin "ELF 375DX".
  - 10. Bird screen:
    - a. 1/2 inch square mesh.
    - b. 16 gage aluminum.
    - c. Install in standard frame.
- B. Anchors, Fasteners, Reinforcing: Aluminum or stainless steel.
- C. Finish:
  - 1. Meet requirements of AAMA 2605.
    - a. PVDF coating with minimum 70 percent resin content.
  - 2. Color: Match color P-2 as specified in Section 09901.
- D. Louver blank-off panels:
  - 1. Materials:
    - a. Plate and frame: Aluminum.
    - b. Insulation: Isocyanurate.
  - 2. Fabrication:
    - a. Plate thickness: 0.050 IN minimum.
    - b. Frame thickness: 0.08 IN.
    - c. Panel: 2 sheets of plate with R-20 core.
    - d. Trim panel with extruded aluminum channel frame matching louver frame.
      - 1) Mitered corners.
    - e. Factory applied flat black painted finish on louver facing side.
- E. Size and shape as indicated in the Drawings.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchoring and bracing accessories as required.
- C. Seal around perimeter on exterior and interior.
  - 1. See Section 07900.
- D. Install 0.040 inch aluminum flashing at sill to match louver.
  - 1. See Section 07620.

**END OF SECTION**

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## **SECTION 10263**

### **STAINLESS STEEL CORNER GUARDS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Stainless steel corner guards.

##### **1.02 QUALITY ASSURANCE (NOT USED)**

##### **1.03 SUBMITTALS**

- A. Procedures: Section 01300.
- B. Product data.
- C. Samples:
  - 1. Corner guard; 12 inches long. Show proposed fastening system and end conditions.

#### **PART 2 PRODUCTS**

##### **2.01 COMPONENTS**

- A. Stainless Steel Corner Guards (SSCG): Model WCG by Wilkinson-Hi-Rise, LLC or CG-50 by Pawling Corporation; 1/8 inch radius corner bend; 16 ga type 304 stainless steel; 3-1/2" wings with returned edges; 48" length unless otherwise indicated.
- B. Adhesives: Maximum VOC of 50g/L.; type as recommended by the adhesive manufacturer for the application.
- C. Fasteners: Stainless steel; countersunk oval head; self-drilling for metal framing.

#### **PART 3 EXECUTION**

##### **3.01 EXAMINATION**

- A. Prior to starting Work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Project Representative, in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

##### **3.02 INSTALLATION**

- A. Install components plumb, tight to substrate surfaces, and in strict accordance with the manufacturer's recommendations.

- B. Start corner guards from top of wall base and adhesively install entire length of guard.

**END OF SECTION**



## SECTION 10405

### SIGNS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies informational and accident prevention and code required signs. Other signage is indicated in the Drawings.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
29 CFR 1910.145	OSHA Specification for Accident Prevention Signs and Tags
ANSI Z535.1	Safety Color Code
ANSI Z535.2	Environmental and Facility Safety Signs
IFC	International Fire Code
NFPA	National Fire Protection Association
SBC	Seattle Building Code
WAC 296-24 (Part B-2)	WISHA Marking Physical Hazards

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Samples of sign materials and mounting hardware and shop drawings of all signs.

##### 1.04 DESIGN REQUIREMENTS

- A. General:
1. Accident prevention signs shall conform to requirements of WISHA Chapter 296-24 WAC (Part B-2), OSHA 29 CFR 1910.145, ANSI Z535.1 and ANSI Z535.2.
  2. Exit signs shall conform to the requirements of IFC 1011 and the local administrative authority.
  3. All signs shall have rounded corners and four mounting holes.
  4. Number, size, type and placement of signs shall be as indicated in the schedules in this Section.
- B. Code Required Signage:
1. Room Occupancy Signs: In a conspicuous location near the main exit, provide signs with minimum 3/4 inch high letters posting each room's occupant capacity in accordance with 1004.3 of the 2012 SBC.
  2. Live Load Capacity Signs: Live load capacity signs shall be provided in the following rooms in accordance with 1603.3 of the 2012 SBC.
  3. Exit Stair Signs: Provide 12 x 12 inch signs at each stair landing in each exit stair, stating the following in accordance with 2012 SBC Section 1019.
    - a. The stair number or designation (1 inch high letters with 1/4 inch stroke).
    - b. Roof Access or No Roof Access as applicable (1 inch high letters with 1/4 inch stroke).
    - c. The floor level (5 inch high letters with 3/4 inch stroke).
    - d. The upper and lower terminus of the stair (1 inch high letters with 1/4 inch stroke).

4. Accessibility Signage:
  - a. Provide acrylic plastic reverse silk screened signs with international symbol of accessibility, raised letters, and Braille, at the following locations:
    - 1) Accessible areas of refuge.
    - 2) Accessible toilet and bathing facilities.
  - b. Provide painted metal international symbol of accessibility at the following locations:
    - 1) Accessible parking locations.
    - 2) Accessible passenger loading zones.
  - c. Provide directional signage at the following in accessible areas to indicate the direction to the nearest similar accessible area:
    - 1) Inaccessible building entrances.
    - 2) In accessible public toilet and bathing facilities.
    - 3) Inaccessible elevators and exit stairs.
  - d. Each door to an exit stairway shall have a tactile sign stating EXIT, which includes raised letters and Braille, and which complies with ANSI A117.1.
5. Fire Door Signage: At the fire doors, provide sign with 1 inch letters which reads:  

FIRE DOOR  
DO NOT OBSTRUCT
6. Operations and Maintenance Support building signage as indicated in the Architectural Drawings.

C. Sign size shall be as follows:

Size	Width x Height
A	14 inches x 20 inches
B	10 inches x 14 inches
C	7 inches x 10 inches
D	14 inches x 10 inches

D. Process and Safety sign type shall be as follows:

Type	Message	Size
100	DANGER – 480 VOLTS	C
101	DANGER - 480 VOLTS	B
102	DANGER - 4160 VOLTS	B
103	DANGER - HIGH VOLTAGE	B
104	DANGER - CONFINED SPACE ENTER BY PERMIT ONLY	B
105	DANGER - CONFINED SPACE AUTHORIZED PERSONNEL ONLY	B
106	DANGER - HOT	B
107	DANGER – ELECTRICAL HAZARD – AUTHORIZED PERSONNEL ONLY	B
108	DANGER – CORROSIVE CHEMICAL	B
109	DANGER – NO SMOKING	B
110	DANGER – KEEP OUT	B
301	CAUTION - NON POTABLE WATER DO NOT DRINK	B
302	CAUTION - CORROSIVE MATERIALS WEAR REQUIRED PROTECTION	B
303	CAUTION - HEARING PROTECTION REQUIRED	B
304	CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME	B
305	CAUTION - LOW CLEARANCE	B
306	CAUTION - HIGH TEMPERATURE	B
401	NOTICE - AUTHORIZED PERSONNEL ONLY	C
402	NOTICE - KEEP THIS DOOR CLOSED	C
403	SOLIDS TRUCK LOADOUT	B
501	SAFETY FIRST - EMERGENCY SHOWER AND EYEWASH	B

Type	Message	Size
502	SAFETY FIRST - PROTECTIVE GEAR REQUIRED WHILE SERVICING	B
503	SAFETY FIRST – EMERGENCY EYEWASH	B
611	DIESEL FUEL STORAGE TANK	D
612	FULL USING KING COUNTY DIESEL FUEL STORAGE TANK STANDARD FILLING PROCEDURES	D
901	STANDARD NFPA DIAMOND HAZARD FOR SPECIFIC CHEMICAL	
902	CHEMICAL COMMON NAME AND CHEMICAL DESIGNATION	
903	KING COUNTY PROPERTY – RESTRICTED ACCESS	

E. Room/Process Area Identification Signs:

1. Provide Room Identification signs indicating room name for every room identified in the table below. Install signs on all doors entering each room.
2. For Process Areas including tanks, basins, equipment areas, equipment enclosures and other features, provide a Process Area identification sign at each entrance to the Process Area, including hatches, manways, walkways and other access points.
3. Sign size to be 10 inches x 2 inches.
4. See table below for room numbers and room names and Process Areas and names.
5. Room/Process Area Schedule:

Room/Process Area	
Room No.	Room/Area Name
Area 200 Regulator	
200.001	GEORGETOWN REGULATOR
200.101	GEORGETOWN REGULATOR ELECTRICAL ROOM
200.151	BRANDON REGULATOR
Area 300 IPS, EQ Basin, and Screening	
300.001	EQUALIZATION BASIN
300.002	INFLUENT PUMP AREA
300.101	SCREENING ROOM
300.102	SAMPLING ROOM
300.103	PANEL ROOM
300.104	C2 ROOM
Area 400 Ballasted Sedimentation	
400.101	COAGULANT STORAGE
400.102	COAGULANT PUMP ROOM
400.103	POLYMER ROOM
400.104	CAUSTIC STORAGE
400.105	CAUSTIC PUMP ROOM
400.110	BALLASTED SED DISTRIBUTION CHANNEL 1
400.111	COAGULATION TANK 1
400.112	MATURATION TANK 1
400.113	SETTLING TANK 1
400.120	BALLASTED SED DISTRIBUTION CHANNEL 2
400.121	COAGULATION TANK 2
400.122	MATURATION TANK 2
400.123	SETTLING TANK 2
400.200	BALLASTED SEDIMENTATION DECK
400.201	HYDROCYCLONE ENCLOSURE
400.S	SE STAIR
400.301	BALLASTED SEDIMENTATION ROOF

Room/Process Area	
Room No.	Room/Area Name
Area 500 UV Disinfection	
500.101	PUMP ROOM
500.111	UV TRAIN 1
500.112	CISTERN 1
500.121	UV TRAIN 2
500.122	CISTERN 2
500.131	C3 STORAGE TANK
500.132	EFFLUENT DROP STRUCTURE
500.133	RECIRCULATION DROP BOX
500.201	UV DISINFECTION DECK
500.S	NE STAIR
500.301	UV DISINFECTION
Area 600 Solids Holding Tank	
600.101	SOLIDS HOLDING TANK
600.200	SOLIDS HOLDING TANK DECK
Area 700 Odor Control	
700.100	ODOR CONTROL AREA
Area 800 Process Electrical Building	
800.101	UV ELECTRICAL ROOM
800.102	BALLASTED SEDIMENTATION ELECTRICAL ROOM
Area 900 Operations and Maintenance Support Building	
900.100	ENTRY ROOM
900.101	WC/F ROOM
900.102	WC/M ROOM
900.103	MEETING AND TRAINING ROOM
900.104	KITCHEN ROOM
900.105	STORAGE ROOM
900.106	CONTROL ROOM
900.107	SAMPLES ROOM
900.108	HALLWAY ROOM
900.109	LOCKER ROOM
900.110	SHOWER ROOM
900.120	SERVER ROOM
900.111	COMMUNICATION ROOM
900.112	JANITOR ROOM
900.113	WC ROOM
900.114	SHOP ROOM
900.115	SHOP STORAGE ROOM
900.116	MAIN ELECTRICAL ROOM
900.201	SHOP MEZZANINE EQUIPMENT ROOM
900.150	STANDBY GENERATOR ROOM
900.151	FUEL TANK
900.5	OM STAIR
900.301	OPERATIONS BUILDING ROOF
900.401	OPERATIONS BUILDING STAIR ROOF

F. NFPA Fire Hazard Material Signs (Type 901):

1. Tanks T854440, T854450, and T854504 and the Defoamer and Polymer Tote areas shall be provided with a minimum of one NFPA fire Hazards Material Sign.
2. Tag Type: Type D – Self-Adhesive Tape Tags and Signs.
3. Size: 7-1/2 IN x 7-1/2 IN.

4. Characteristics:
  - a. Four (4) color background, blue, red, yellow, white.
  - b. Diamond shape conforming to NFPA No. 704 System for identifying fire hazards of materials.
5. Legend letter height: 3-inch-high black hazard numerals.
6. Schedule for T854440:
  - a. Quantity: 1
  - b. Location: Place in a visible location on each tank.
  - c. Text/Symbol:
    - 1) Hazardous Material: Coagulant (Polyaluminum Chloride).
    - 2) Health: 2.
    - 3) Fire: 0.
    - 4) Reactivity: 0.
    - 5) Specific Hazard: None.
7. Schedule for T854450:
  - a. Quantity: 1.
  - b. Location: Place in a visible location on each tank.
  - c. Text Symbol:
    - 1) Hazardous Material: Sodium Hydroxide 25 wt%.
    - 2) Health: 2.
    - 3) Fire: 0.
    - 4) Reactivity: 0.
    - 5) Specific Hazard: None.
8. Schedule for T854504:
  - a. Quantity: 1.
  - b. Location: Place in a visible location on each tank.
  - c. Text/Symbol:
    - 1) Hazardous Material: Citric Acid.
    - 2) Health: 2.
    - 3) Fire: 0.
    - 4) Reactivity: 0.
    - 5) Specific Hazard: None.
9. Schedule for Defoamer Area:
  - a. Quantity: 1.
  - b. Location: Place in visible location near of the tote.
  - c. Text/Symbol:
    - 1) Hazardous Material: Defoamer.
    - 2) Health: 1.
    - 3) Fire: 0.
    - 4) Reactivity: 0.
    - 5) Specific Hazard: None.
10. Schedule for Polymer Area:
  - a. Quantity: 1.
  - b. Location: Place in a visible location near the tote.
  - c. Text/Symbol:
    - 1) Hazardous Material: Polymer.
    - 2) Health: 1.
    - 3) Fire: 1.
    - 4) Reactivity: 0.
    - 5) Specific Hazard: None.

## **PART 2 PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Brady.
- B. Seton.
- C. Approved Equal.

### **2.02 FABRICATION**

- A. Accident prevention signs: fadeproof graphic permanently embedded 1/8 -inch-thick fiberglass reinforced plastic; guaranteed not to chip, fade or peel for 15 years.
- B. Building identification signs:
  - 1. 12-inch by 30-inch fiberglass with fadeproof graphic permanently embedded 1/8 -inch-thick fiberglass reinforced plastic; guaranteed not to chip, fade or peel for 15 years.
  - 2. Brown background with a white border and white lettering. Helvetica light of medium lettering.
    - a. Upper case lettering: 3 inches high.
    - b. Lower case lettering: 2-1/4 inches high.
- C. Blade-type signs: Wall or ceiling mounted, projecting outward with information on both sides.
- D. Chain-mounted signs: Provide information on both sides.
- E. Room Identification Signs: Aluminum Suitable for raised lettering and Braille.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Install signs as listed in Schedule of Signs. See Attachment A of this Section.
- B. All 480V junction boxes shall be labeled with sign type 100.
- C. All 480V MMC's and switch gears shall be labeled with sign type 101.
- D. All electrical room entrance doors shall be labeled with sign type 107.
- E. All utility stations shall be equipped with sign B301 as indicated in the Drawings.
- F. Additional signage provided by the UV System Supplier as indicated in the Drawings.
  - 1. Mount signs as required by the manufacturer at the locations indicated.
- G. Provide and install all signage as scheduled and required by code.
- H. Equipment where more than one voltage source is present shall be labeled with a sign stating "MULTIPLE VOLTAGE SOURCES".

### **3.02 EXECUTION**

- A. Do not begin production until all shop drawings have been approved.
- B. Fasten surface-mounted signs to wall with expansion bolts or suitable anchors.
- C. Conceal all fasteners as much as possible.
- D. Use backup materials as required to achieve concealed mounting.
- E. Mount posts as indicated in the Drawings.
- F. Room identification signs shall be mounted on exterior of the door to show the name of the room to be entered.

**END OF SECTION**

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**ATTACHMENT A**

**SCHEDULE OF SIGNS**

Sign Type	Sign Mounting	Area 100 Site	Qty.	Area 200 Regulator	Qty.	Area 300 IPS/EQ Basin	Qty.	Area 400 Ballasted Sed	Qty.	Area 500 UV Disinfection	Qty.	Area 600 Solids Holding Tank	Qty.	Area 700 Odor Control	Qty.	Area 800 Process Electrical Building	Qty.	Area 900 Ops, Maintenance and Gen. Building	Qty.	County Selected – Text TBD	Qty.
100	TBD			X	2			X	8	X	8			X	2						
101	TBD			X	2	X	2			X	8			X	2	X	10	X	4		
102	TBD	X	2													X	4				
103	TBD	X	2	X	2	X	2			X	4			X	2	X	8	X	4		
104	TBD			X	2	X	2														
105	TBD			X	2	X	2														
106	TBD																	X	2		
107	TBD															X	2	X	2		
108	TBD							X	2	X	3										
109	TBD	X	4															X	4		
110	TBD																				
301	TBD			X	2			X	14	X	14	X	8	X	8						
302	TBD							X	2									X	2		
303	TBD					X	4			X	2			X	2			X	2		
304	TBD			X	2	X	10			X	8			X	2			X	2		
305	TBD									X	2			X	2						
306	TBD																				
401	TBD			X	2	X	4			X	2										
402	TBD					X	4					X	1			X	2	X	8		
403	TBD																				
501	TBD							X	6	X	3										
502	TBD									X	8										
503	TBD							X	1												
611	TBD																	X	1		
612	TBD																	X	1		
901	TBD							X	3	X	3										
902	TBD									X	3										
903	TBD	X	4	X	2																
Size B	TBD																			X	50

**END OF SECTION**

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## SECTION 10500

### LOCKERS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies all steel lockers. All lockers shall be of the single-person type. Unless otherwise indicated, lockers shall be power ventilated.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Catalog data for products.

#### PART 2 PRODUCTS

##### 2.01 ACCEPTABLE MANUFACTURER

- A. Lyon Metal Products.
- B. Penco.
- C. Republic Storage Products.
- D. Approved Equal, modified as necessary to provide the specified features.

##### 2.02 MATERIALS AND EQUIPMENT

- A. Doors:
  - 1. General: Doors and door frames shall be No. 16 U.S. standard gage cold-rolled and leveled sheet steel reinforced or stiffened to prevent distortion.
  - 2. Locking Devices:
    - a. Positive, automatic, pre-locking type which permit the lockers to be locked while the doors are open, then closed without unlocking.
    - b. The locking bars shall be enclosed, tamper-proof and equipped with 3 locking points.
    - c. Use rubber silencers to prevent metal-to-metal contact in the locking devices or otherwise to minimize noise generated by opening and closing the doors.
    - d. Handles: Die cast nonferrous metal with provisions for padlocks and having a padlock strike.
  - 3. Hinges: Each door shall have at least three 2-inch-wide tight pin style hinges.
  - 4. Number Plates: Mount metal number plates with etched or stamped consecutive numbers at least 1/2 inch in height on the doors.

5. Louvers:
  - a. Louver doors as indicated.
  - b. Louvers: At least 6 inches wide and extending out 1/4 inch from the face of the door.
  - c. Provide at least 6 blades with each louver.
- B. Body:
  1. General:
    - a. 15 inches wide, 21 inches deep, 72 inches high, double tier
    - b. Provide sloping tops where shown.
  2. Construction: Body, consisting of upright sheets, backs, tops, bottoms and shelves, to be of not lighter than No. 24-gage mild cold-rolled steel free from imperfections.
  3. Bolts and nuts shall be zinc-plated.
  4. The top of each locker shall be perforated with 1/4-inch holes on 1-inch centers each way to provide passage to the power ventilation system.
- C. Trim Angles:
  1. Provide to cover the gap at the ends and across the top of each locker section at junctions with walls.
  2. Dimensions: 3 inches wide and not less than 18-gage steel with returns.
- D. Base: Design lockers for installation as indicated.
- E. Accessories:
  1. Hat Shelf:
    - a. Each locker shall have 1-hat shelf with a reinforced or stiffened front edge located approximately 9 inches below the top of the locker.
    - b. The shelf shall be perforated with 1/4-inch holes on 1-inch centers each way.
  2. Hooks:
    - a. Each locker compartment shall have 1 double-prong ceiling hook and 3 single-prong wall hooks (1 on each wall).
    - b. All hooks shall be steel, have ball points and be attached with 2 bolts or rivets.
- F. Locker Finish: After fabrication, clean all steel surfaces of all oil and grease, phosphatize to inhibit corrosion, and finish with a prime coat and 2 coats of baked-on enamel in the selected color.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install lockers stainless steel screws.
- B. Fasten sides and back of units directly to framing at the top and the bottom.
- C. Provide one set of fasteners for every other locker.

**END OF SECTION**

## SECTION 10520

### PORTABLE FIRE EXTINGUISHERS AND CABINETS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies fire extinguishers and semi-recessed cabinets.
- B. Type: Fire extinguishers shall be of the multi-purpose dry chemical type as specified in this Section.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
UL 299	Fire Extinguishers, Dry Chemical
NFPA 10	Standard for Portable Fire Extinguishers

- B. Performance and design requirements:
  - 1. The fire extinguisher system shall meet the requirements of the City of Seattle Fire Department.
  - 2. The multipurpose dry chemical fire extinguishers shall be UL and ULC rated at 4A-40-B:C.
  - 3. All fire extinguishers shall comply with Underwriters Laboratory Standard 299, shall bear Factory Mutual Certification Underwriters Laboratories Certification, and shall be listed by the State Fire Marshal.
  - 4. Distribution and installation of all fire extinguishers shall be in conformance with NFPA No. 10.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Provide manufacturer's technical data and application information.
- C. Written verification from the City of Seattle Fire Department that installation of the extinguishers meet permit and code requirements.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS

- A. Doors of fire extinguisher cabinets:
  - 1. 0.062 inch extruded aluminum etched to a satin finish and anodized to prevent corrosion.
  - 2. Tubular construction with an aluminum continuous hinge and a positive cam catch.
- B. Frames of fire extinguisher cabinets: 0.062 inch extruded aluminum etched to a satin finish and anodized to prevent corrosion.

## **2.02 EQUIPMENT**

- A. Type A: cabinet mounted.
- B. Type B: column or wall mounted.
  - 1. Extinguishers shall be 10 pounds.
- C. Wall brackets:
  - 1. Bracket type to fit specified extinguisher.
  - 2. Furnish bracket for each extinguisher not in cabinet.
  - 3. Bracket to be finished in red or black enamel.
- D. Fire Extinguisher Signage:
  - 1. Single faced: SETON #21999.
  - 2. Double faced: SETON #22001.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install fire extinguishers as shown in the Drawings, and/or as described in this Section.
  - 1. Obtain final location approval from Project Representative.
  - 2. Refer to the Drawings for locations.

**END OF SECTION**

## SECTION 10810

### TOILET AND BATH ACCESSORIES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section specifies toilet and bath accessories, shower seat, and fold down baby counter.

##### 1.02 QUALITY ASSURANCE

- A. Referenced Standards: This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI A117.1	American National Standards Institute. Accessible and Usable Building Facilities
ASTM F446	Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

##### 1.03 SUBMITTALS

- A. Procedures: Section 01300.
- B. Product Data: Submit manufacturers detailed product data for each accessory.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and product designations indicated.

##### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver accessories to Site until rooms in which they are to be installed are ready to receive them.
- B. Pack accessories individually in a manner to protect accessory and its finish.

##### 1.05 COORDINATION

- A. Verify locations and dimensions with field conditions prior to installation.
- B. Avoid damaging the work or finish of other trades; repair damage, or replace damaged items, as directed, at no additional cost.

##### 1.06 MAINTENANCE

- A. Keys: Provide universal keys for serving and resupplying accessories. Furnish a minimum of 6 keys to the Project Representative.

## **PART 2 PRODUCTS**

### **2.01 ACCESSORIES**

- A. Acceptable manufacturers:
  - 1. Bobrick Washroom Equipment Company.
  - 2. Approved Equal.
- B. Furnish the following, unless approved otherwise.
  - 1. Semi-Recessed Paper Towel Dispenser/Waste Receptacle: B-3803 or Approved Equal.
  - 2. Toilet Paper Dispenser (J): B-2888 or Approved Equal.
  - 3. Surface Mounted Seat Cover Dispenser (H): B-4221 or Approved Equal.
  - 4. Framed Mirror (MIR): B-165 2448 or Approved Equal.
  - 5. Grab Bars (N): B-6806 Series, size and configuration as indicated; include concealed anchor devices.
  - 6. Soap Dispensers:
    - a. Wall Mounted Soap Dispenser (B2): 818615 or Approved Equal.
  - 7. Feminine Napkin Dispenser: B-3706 or Approved Equal; 25 cent coin operation.
  - 8. Sanitary Napkin Disposer:
    - a. Surface Mounted (K2): B-270 or Approved Equal.
  - 9. Mop and Broom Holder: B-223-36 inches or Approved Equal.
- C. Shower Seat: Folding shower seat; Bobrick model B-5181 or Approved Equal.
- D. Shower Rod: B6047; Classic Series Extra Heavy Duty Shower Curtain Rod or Approved Equal, 18 Gauge.
- E. Baby Changing Station (G):
  - 1. Basis of Design: KB110-SSWM Koala Kare Horizontal Wall Mounted Baby Changing Station or Approved Equal.
  - 2. Surface Mounted.
  - 3. 18 gage stainless steel exterior finish with HDPE interior shell with stainless steel hinges, counterbalance, safety straps and bed liner dispenser.
  - 4. Bed Liners: Manufacturer's standard to fit dispenser. Bobrick KB150-99 or Approved Equal; 2 boxes.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Prior to starting Work, carefully inspect installed work of other trades and verify that such Work is complete to the point where Work of this Section may properly commence. Notify the Project Representative in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning Work constitutes acceptance of Site conditions and responsibility for defective installation caused by prior observable conditions.

### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to jobsite for building-in. Coordinate installation.
- B. Furnish templates and rough-in measurements as required.



- C. Protect adjacent or adjoining finished surfaces from damage during installation of Work of this Section.
- D. Verify exact location of accessories.
- E. Coordinate installation of blocking and backing as necessary to support wall mounted items.

### **3.03 INSTALLATION**

- A. Install accessories using fasteners to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- C. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.
- D. Mounting Locations:
  - 1. Mount accessories in locations and elevations as indicated in the Drawings.
  - 2. Where location is not indicated, mount at the minimum elevation recommended by the manufacturer. Verify Location with the Project Representative, prior to placement.
  - 3. Mount Mop and Broom holders at 4 feet-0 inches AFF to top of shelf over mop sink.
  - 4. Where thru-partition mount combination units with toilet tissue dispensers are indicated, orient units to position with toilet tissue dispensers furthest from wall, or as necessary for compliance with ANSI A117.1.
- E. Use tamper-resistant fasteners.

**END OF SECTION**

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