

City of St. Charles School District R-VI

Additions & Alterations To:

George M. Null Elementary School
435 Yale Boulevard
St. Charles, Missouri 63301

Project Manual

Volume 2

January 10, 2023



**ADDITIONS AND ALTERATIONS TO GEORGE M. NULL ELEMENTARY SCHOOL
CITY OF ST. CHARLES SCHOOL DISTRICT**

St. Charles, Missouri

DHA Project Number: 202127
January 10, 2023

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CITY OF ST. CHARLES SCHOOL DISTRICT
ADDITIONS & ALTERATIONS TO
GEORGE M. NULL ELEMENTARY SCHOOL

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SECTION 03041 - UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.1 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor barrier and installation accessories for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03300 Cast-in-Place Concrete
 - 2. Section 03051 Concrete Moisture Vapor Reduction Admixture

1.2 REFERENCES

- A. ASTM International
 - 1. ASTM E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643-18a: Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 - 2. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 - 2. Manufacturer's samples and literature.
 - 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
 - 5. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
 - 6. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
 - 7. Manufacturer verify in writing 20 years in the industry with no reported product failures.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
 4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
- B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com
 2. Approved Alternate: VaporGuard by Reef Industries, 713-507-4250. www.reefindustries.com.
 3. Approved Alternate: Moistop Ultra15 by Fortifiber Building Systems Group. 800-773-4777. www.fortifiber.com.
 4. No substitutions.

2.2 ACCESSORIES

- A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- C. Perimeter/terminated edge seal:
1. Stego Crete Claw (textured tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 4. One-sided seaming tape is not a recommended method of sealing at the terminated edge.
- D. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- E. Vapor Barrier-Safe Hand Screed System
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.
- B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
- OR
- b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
 7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION - 03041

SECTION 03051 - CONCRETE MOISTURE VAPOR REDUCTION ADMIXTURE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Moisture Vapor Reducing Admixture (MVRA) for new concrete slabs on grade.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 03300 - Cast-in-place Concrete: Under slab vapor retarder.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of following:
 - 1. Blended hydraulic cement.
 - 2. Fly ash and other pozzolans.
 - 3. Ground granulated blast-furnace slag.
 - 4. Silica fume.

1.3 REFERENCES

- A. American Concrete Institute (ACI)(www.concrete.org):
 - 1. 302.2R-06 - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring.
 - 2. 305R-10 - Guide to Hot Weather Concreting.
 - 3. 306R-10 - Guide to Cold Weather Concreting.
- B. ASTM International (ASTM)(www.astm.com):
 - 1. C494/C494M: Standard Specification for Chemical Admixtures for Concrete.
 - 2. D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 - 3. E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
 - 4. E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - 5. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- C. National Ready-Mix Concrete Association (NRMCA)(www.nrmca.org - Certification of Ready Mixed Concrete Production Facilities.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data for admixture.
 - 2. Warranties:
 - a. Sample lifetime warranty against flooring/coating failure due to concrete moisture vapor emission (MVE).
 - b. Sample adhesion warranty.

- B. Quality Control Submittals:
 - 1. Certificate of Compliance: Manufacturer's statement certifying admixture provided meets or exceeds specified requirements.
 - 2. Test Reports: Test results performed by qualified independent testing agency evidencing compliance of products with specified requirements of moisture vapor transmission based on ASTM D5084.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Firm experienced in manufacture of concrete MVRA.
 - 2. Capable of providing test reports indicating compliance with specified performance requirements and with ASTM C494/C494M testing protocols, from independent AASHTO approved laboratory.
 - 3. Able to provide on-site technical assistance if requested.
- B. Ready Mixed Concrete Manufacturer Qualifications:
 - 1. Firm experienced in manufacturing ready-mixed concrete products.
 - 2. Comply with ASTM C94/C94M requirements for production facilities and equipment.
 - 3. Manufacturer certified according to NRMCA certification procedures.
- C. Slab Moisture Testing and Evaluation: (owner's testing agency)
 - 1. Personnel performing laboratory tests: Certified in conduct of ASTM D5084 under supervision of licensed geotechnical engineer.
 - 2. Determination of whether concrete slab is prepared to receive flooring, coatings, or roofing rests with MVRA manufacturer.
- D. Obtain concrete moisture vapor reducing admixtures from same manufacturer.
- E. Slabs to Receive Moisture Sensitive Coatings or Material: Comply with ACI 302.2R-06.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store products in temperature-controlled area above 40 degrees, protected from exposure to harmful weather conditions
- B. Do not allow products to freeze.

1.7 WARRANTIES

- A. Provide manufacturer's lifetime warranty against concrete induced moisture vapor failure, providing coverage for:
 - 1. Repair or removal of failed flooring.
 - 2. Placement of topical moisture remediation system.
 - 3. Replacement of flooring to match original including material and labor.
- B. Provide manufacturer's adhesion warranty, matching terms of adhesive or primer manufacturer's material adhesion warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Contract Documents are based on MVRA 900 by ISE Logik Industries, Inc. (www.iselogik.com). Dean E. Craft, decraft@iselogik.com; 585.474.3553.
- B. Substitutions: Under provisions of Division 1. General Requirements.

2.2 MATERIALS

- A. Concrete Moisture Vapor Reduction Admixture (MVRA):
 - 1. Non-toxic, volatile organic compound (VOC) free, liquid admixture formulated to react with hydroxide ions produced by cement hydration process, creating additional hydration products within capillary pores, blocking moisture vapor movement through concrete.
 - 2. Physical characteristics:
 - a. Hydraulic conductivity: Project specific maximum of 6.0 E-8 cm/s per ASTM D5084.
 - b. Toxicity: None.
 - c. Odor: None.
 - d. Flammability: None.
 - e. Volatile Organic Compound (VOC) content: 0 grams per liter.
 - f. Freeze temperature: 32 degrees F (0 degrees C).
 - g. pH: 11.3.

2.3 ACCESSORIES

- A. Sheet Vapor Retarder: Specified in Section 03300.

2.4 MIXES

- A. Add MVRA to concrete mix in accordance with manufacturer's instructions.
- B. Add MVRA at rate of 12 ounces per 100 pounds (355ml/45kg) of total cementitious materials.
- C. Replace mix water on one-for-one basis in amount equal to amount of MVRA added.
- D. Add MRVA directly to freshly mixed concrete at end of the batch process with tail water.
- E. Ready-Mixed Concrete:
 - 1. Measure, batch, mix, and deliver concrete with MVRA in accordance with ASTM C94/C94M.
 - 2. Furnish batch ticket information showing dosage of MVRA.
- F. Freshening onsite with held back mix water is acceptable if in accordance with ACI guidelines and if amount does not exceed original water to cementitious material ratio or instructions of Structural Engineer.
- G. Use water reducing admixtures to achieve desired slump.
- H. Use of other admixtures in same batch as MVRA is acceptable if each admixture is added separately.
- I. Do not use shrink reducing admixtures.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Comply with requirements of Section 03300 for concrete mixing, placing, and curing.
- B. Protect and repair sheet vapor retarder in accordance with to ASTM E1643, ASTM F710, ACI 302.2R-06, and manufacturer's instructions.
- C. Cold Weather Placement: Comply with ACI 306R-10.
- D. Hot Weather Placement: Comply with ACI 305R-10.

3.2 CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R-10 for cold-weather protection and ACI 305R-10 for hot-weather protection during curing.
- B. Cure concrete slabs to receive moisture sensitive coatings according to ACI 302.2R-06 by one or more of following methods:
 - 1. Moisture-retaining cover curing.
 - 2. Self-dissipating curing compound.

3.3 FIELD QUALITY CONTROL

- A. Moisture Vapor Reduction Admixture (MVRA) Manufacturer: Pre-test manufactured production lots for conformance with published limits of hydraulic conductivity per ASTM D5084 prior to shipping.
- B. If required by project, project specific quality control process shall consist of the concrete moisture vapor reduction admixture representative procuring one random cylinder from every day of placement of concrete containing the concrete moisture vapor reduction admixture. These cylinders shall be sent to an independent laboratory for hydraulic conductivity (coefficient of permeability) per ASTM D5084. The results of this "project specific" quality control protocol shall form the basis for the issuance of the project specific warranty.
 - 1. Should the Quality Control Protocol deliver results in excess of 6.0 E-08 cm/sec, the concrete moisture vapor reduction admixture manufacturer shall be permitted to core the project slab in order to test the in-place concrete per ASTM D5084.
 - 2. If the core delivers results less than 6.0 E-08 cm/sec, no further action is required
 - 3. If the core delivers results in excess of 6.0 E-08 cm/sec, the concrete moisture vapor admixture manufacturer shall provide, at their expense, a warranted topical moisture mitigation system or product for all areas not meeting the stated limit; including concrete slab preparation, material, and installation.
- C. Ready Mix Producer: Provide batch tickets indicating presence and dosage of MVRA in mix.

END OF SECTION 03051

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings and Grade Beams.
 - 2. Foundations walls.
 - 3. Slabs-on-grade.
- B. Related requirements:
 - 1. Section 03041; Vapor-Slab Vapor Barrier.
 - 2. Section 03051; Concrete Moisture Vapor Reduction Admixture.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcement required at opening through concrete elements. Walls, beams, and grade beams shall be drawn in elevation. After

the first shop drawing submittal, all new or changed items shall be clouded on subsequent submittals.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Waterstops.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. 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.
 - 2. 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. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 117 (ACI 117M).
2. ACI 301 (ACI 301M)

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- C. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I.
 - 2. Fly Ash: ASTM C 618, Class F.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1 inch (38 mm) for slab-on-grade and footings, 3/4 inch (19 mm) for all other cast-in-place concrete, nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

- H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- I. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Flat dumbbell with center bulb.
 - 2. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick).
- B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 2. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and are acceptable to Architect
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Design mixes to provide concrete with the properties indicated on Drawings.
- B. Adjustment of Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by architect. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in work.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise noted.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Coordinate work with requirements of all other trades and notify Architect/Engineer of all conflicts and non-conforming conditions.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Retain applicable subparagraphs below and insert others if required. Revise to suit Project.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 4. Install dovetail anchor slots in concrete structures as indicated.
 5. Do not place embedded items or dowels in fresh concrete. Accurately locate and place all embedded items and dowels prior to placing concrete.
 6. Securely fasten anchor bolts, inserts, form blockouts, and other items built into concrete to formwork or hold place with templates. Do not insert into concrete after or during casting.
 7. Do not install sleeves or blockouts in joints, beams or columns except where shown on structural drawings or as approved by Architect/Engineer.
 8. Do not embed aluminum items.
 9. Set anchor bolts perpendicular to theoretical bearing surface, unless shown otherwise.
- B. Tolerance for anchor bolts and other embedded item:
1. 1/16-inch center to center of any two bolts within an anchor bolt group, where an anchor bolts group is defined as the set of anchor bolt which receive a single fabricated steel shipping piece.
 2. 1/4-inch center to center of adjacent anchor bolt groups.
 3. Elevation top of anchor bolts plus or minus 1/2 inch.
 4. Maximum accumulation of 1/4-inch per hundred feet along the established column line of multiple anchor bolt groups, but not to exceed a total of 1 inch. The established column line is the actual field line most representative of the centers of as-built anchor bolt groups along a line of columns.
 5. Plus or minus 1/8-inch from the center of any anchor bolt group to the established column line through that group.
 6. Where individual columns are shown on the plans to offset from established column centerlines, tolerances of above paragraphs apply to offset dimensions shown on the plans, measured parallel and perpendicular to the nearest established column line.
 7. Set other embedded items or connection material furnished by others for embedment in concrete, in accordance with tolerance requirements of Section 7.11.3 of the AISC Code of Standard Practice for Steel buildings and Bridges - 1986 Edition.
- C. Pipes & Conduits embedded in slabs are not allowed unless approved by architect. Conduits are subject to the requirements of ACI 318 Section 6.3 and the following criteria:
1. Outside diameter of conduit shall not exceed 1/3 of the thinnest concrete cover on metal deck.

2. Provide 3/4" minimum concrete cover above, below and on sides of conduit. Crossovers are only permitted when this minimum cover can be maintained.
3. Minimum spacing between conduits is 18".
4. Support conduit on bolsters, chairs or spacers used for reinforcing bars.
5. Conduit shall not displace reinforcing steel.
6. When conduit is parallel to Wide Flange beams, minimum distance from headed studs on beam to conduit shall be 18".

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Space vertical joints in walls at 50ft maximum intervals and as otherwise required to control shrinkage. Locate at points of minimum shear.
 - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth as indicated on the drawings and as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete. Concrete placed on metal deck should be placed uniformly and not be allowed to accumulate in localized areas prior to screeding or consolidating.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Scream slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade
 - b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before

- proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Install levelling material to areas of slab as required to project's slab tolerances and to properly install flat and level flooring, equipment, and furnishings.
- F. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- G. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 03300

SECTION 03410 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Precast structural concrete with commercial architectural finish.

- B. Related Requirements:

- 1. Section 03300 "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete.
- 2. Section 05120 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
- 3. Section 05500 "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.
- C. Shop Drawings:
 - 1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.

2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate separate face and backup mixture locations and thicknesses.
5. Indicate type, size, and length of welded connections by AWS standard symbols.
6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
8. Include and locate openings larger than 10 inches (250 mm). Where additional structural support is required, include header design.
9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
10. Indicate relationship of precast structural concrete units to adjacent materials.
11. Indicate estimated camber for precast floor slabs with concrete toppings.
12. Indicate shim sizes and grouting sequence.
13. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples:

1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of three, representative of finish, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).
 - a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, and texture of backup concrete as well as facing concrete.

E. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and testing agency.
- B. Welding certificates.
- C. Material Certificates: For the following:
 1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.

4. Bearing pads.
 5. Structural-steel shapes and hollow structural sections.
- D. Material Test Reports: For aggregates, by a qualified testing agency.
 - E. Preconstruction test reports.
 - F. Source quality-control reports.
 - G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 1. Designated as a PCI-certified plant as follows:
 - a. Group C, Category C1 - Precast Concrete Products (no prestressed reinforcement), Category C2 - Prestressed Hollowcore and Repetitively Produced Products, Category C3 - Prestressed Straight Strand Structural Members, Category C4 - Prestressed Deflected Strand Structural Members.
- B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S1 – Simple Structural Systems.
- C. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in Category S1 – Simple Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."
- D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- E. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - 2. Place adequate dunnage of even thickness between each unit.
 - 3. Place stored units so identification marks are clearly visible, and units can be inspected.
- C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design precast structural concrete units.
- B. Design Standards: Comply with ACI 318 (ACI 318M) and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- C. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1 (ACI 216.1M) and PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.
- D. Structural Performance: Precast structural concrete units and connections shall withstand design loads as indicated on the structural drawings within limits and under conditions indicated.
 - 1. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated or to match those used for precast concrete design reference sample. Furnish with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M or ASTM A 1064/A 1064M, flat sheet.
- F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.4 PRESTRESSING TENDONS

- A. Pretensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, seven-wire or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, seven-wire], low-relaxation strand.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C 618, Class N.
 - 3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 5. Blended Hydraulic Cement: ASTM C 595/C 595M, cement.

- C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 - 9. Corrosion-Inhibiting Admixture: ASTM C 1582/C 1582M.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- D. Malleable-Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

- K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M) or ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
 - 1. Do not zinc coat ASTM A 490 (ASTM A 490M) bolts.
- L. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead-and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 and SSPC-Paint 25 according to SSPC-PA 1.
- M. Welding Electrodes: Comply with AWS standards.
- N. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.7 BEARING PADS

- A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
 - 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
 - 4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 - 5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 ACCESSORIES

- A. Reglets: PVC extrusions, Stainless steel, Type 302 or Type 304, Copper, felt or fiber filled, or with face opening of slots covered, unless noted otherwise.
- B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.9 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 2. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.11 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.12 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds

- limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 5. Protect strand ends and anchorages with a minimum of **1-inch- (25-mm-)** thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of **1 inch (25 mm)** or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.13 CASTING INSULATED WALL PANELS

- A. Cast, screed, and consolidated wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below 150 deg F (65 deg C) in bottom concrete wythe.

2.14 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.15 COMMERCIAL FINISHES

- A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch (3 mm) and fill holes larger than 1/4 inch. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).

- B. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch (1.6 mm) in width or smaller, and form marks where the surface deviation is less than 1/16 inch (1.6 mm). Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.
 - 1. Exposed edges of panels.
- C. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
 - 1. Exposed faces of panels, interior face.
- D. Apply roughened surface finish according to ACI 318 (ACI 318M) to precast concrete units that receive concrete topping after installation.

2.16 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.
 - 1. Test and inspect self-consolidating concrete according to PCI TR-6.
- C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 - 1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 - 2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
 - 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 - 4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.

- e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels. Replace unacceptable units with precast concrete units that comply with requirements.

2.17 COMMERCIAL ARCHITECTURAL FINISHES

- A. Manufacturer member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform and straight. Finish exposed-face surfaces of precast concrete units to match approved sample panels and as follows:
 - 1. As-Cast-Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
1. Do not permit connections to disrupt continuity of roof flashing.
- D. Field cutting of precast units is not permitted without approval of Architect.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.
- H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.

2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.5 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03410

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU's).
2. Face brick.
3. Mortar and Grout
4. Reinforcing steel
5. Masonry Joint Reinforcing
6. Ties and Anchors
7. Cavity Wall Insulation
8. Stainless Steel Fabric Flashing

B. Related Sections:

1. Division 5 Section "Metal Fabrications" for furnishing loose steel lintels and shelf angles for unit masonry.
2. Division 7 Section "Fluid Applied Membrane Air Barrier for coating C.M.U. backup.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 - a. Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314. Strength to meet requirements as defined on the structural contract documents.
2. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

- ##### B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." 1.
1. Show elevations of reinforced walls.
 2. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

C. Samples for Verification: For each type and color of exposed masonry unit and colored mortar.

- D. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties and material test reports substantiating compliance with requirements.
- E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports per ASTM C 780 for mortar mixes.
 - 2. Include rest reports per ASTM C 1019 for grout mixes.

1.4 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 - 1. Build a minimum of 3 sample panels for each type of exposed unit masonry construction and typical exterior wall in sizes approximately 48 inches long by 60 inches high.

1.5 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- C. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- D. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- C. Integral Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.
- D. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
 - 2. Density Classification: Light weight for interior partitions and exterior wall back up. Normal weight for exterior exposures where used for patching and infill on the rear (north) wall of the existing building.

2.3 BRICK

- A. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 3. Refer to drawings for locations and types of special brick.
- B. Face Brick: Sioux City Adobe Velour, (Centennial Collection) Modular Size.
- C. Reveal Brick: Sioux City Brown Velour, (Adel, Iowa Plant) Modular Size.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Masonry Cement: ASTM C 91
- C. Mortar Cement: ASTM C 1329
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Solomon Colors, Inc.; SGS Mortar Colors.
- F. Aggregate for Mortar: ASTM C 144.
 1. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- I. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 1. Interior Walls: Mill-galvanized, carbon steel.
 2. Exterior Walls: Hot dip galvanized steel.
 3. Wire Size for Side Rods: As indicated on the drawings.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Wire Size for Veneer Ties: As required by design, 0.148-inch diameter, minimum.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Wire: Fabricate from 1/4-inch diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch diameter, hot-dip galvanized steel wire.
- E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel wire.
- F. Partition Top anchors: 0.105-inch thick metal plate with 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- H. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2.7 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: The following:

1. Stainless Steel Fabric Flashing:

a. Products: Provide the following:

1) Multi-Flash SS System by York Flashing.

2. Warrant flexible flashing/drainage system material for life of wall.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Adhesives, Primers, and Splice Flashings: Flashing manufacturer's standard products.

D. Termination Bars: By flashing manufacturer.

E. Sealant at top of termination bars: By flashing manufacturer.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Mortar Net USA, Ltd: Mortar Net Weep Vents.

D. Expansion Joint Bellows: Fabricate from 16. Oz copper.

2.9 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

1. Styrofoam Cavity Mate Plus by Dow (1 1/2" thick).

2. R-Value: R7.5 min.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.
 3. For exterior masonry, use portland cement-lime mortar.
 4. For reinforced masonry, use portland cement-lime mortar.
 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of masonry cement by weight.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Face brick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
 - 1. Construct special features as shown on the drawings including quoins, corbels, recessed panels, water tables, projecting and recessed bands, recessed panels, rowlock and soldier courses, and other special features as shown.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry to match existing; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed exterior joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated. Provide rake joints for interior face brick.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Apply air barrier to face of backup wythe to comply with Division 7 Section "Fluid-Applied Membrane Air Barriers."
- D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than as detailed between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections and connector sections and continuous wire in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry (interior & exterior) as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement. Reference NCMATEK 10-2B, or similar code provision, for control joint location.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
 - 3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level B special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- I. Prism Test: For each type of construction provided, per ASTM C 1314 at 28 days

3.14 REPAIRING

- A. Remove and replace masonry units that are loose, chipped, broken, spalled, pockmarked, missing corners out of alignment, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

3.15 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Test cleaning methods on sample wall panel; leave one-half of panel unclean for comparison purposes.
 2. Protect surfaces from contact with cleaner.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.16 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
- 2. Grout.

- B. Related Requirements:

- 1. Section 05121 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
- 2. Section 05310 "Steel Decking" for field installation of shear connectors through deck.
- 3. Section 05500 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.
- 4. Section 09911 "Exterior Painting".

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Load and Resistance Factor Design; data are given at factored-load level, unless noted otherwise.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, $F_y = 46\text{ksi}$, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, unless noted otherwise, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain or Hot-dip zinc coating.
- F. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.

2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened [ASTM A 36/A 36M] carbon steel.
3. Finish: Plain or Hot-dip zinc coating.

2.4 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" and SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened and/or Slip critical, as required.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize exposed steel, lintels, shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or slip critical, as required.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05120

SECTION 05210 - STEEL JOIST FRAMING

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. CJ-series composite steel joists.
3. Joist accessories.

B. Related Requirements:

1. Section 03300 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 04200 "Unit Masonry" for installing bearing plates in unit masonry.
3. Section 05120 "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. Provide comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation, licensed in the State of the Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Manufacturer certificates.
- C. Mill Certificates: For each type of bolt.
- D. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Canam Steel Corporation; Canam Group, Inc.
 - 2. CMC Joist & Deck.
 - 3. Goeder-Henrichsen Co.
 - 4. New Millennium Building Systems, LLC.
 - 5. Structures of U.S.A., Inc.

6. Valley Joist.
7. Vulcraft; Nucor Vulcraft Group.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 1. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/360 of the span.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 1. Joist Type: K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Do not camber joists.
- G. Camber joists according to SJI's "Specifications."
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 COMPOSITE STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with underslung ends, unless noted otherwise.
- B. Camber composite steel joists as indicated.

2.5 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.6 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated.
- C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."
- D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.
- E. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Plain.
- F. Welding Electrodes: Comply with AWS standards.
- G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.7 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
 - b. Magnetic Particle Inspection: ASTM E 709.

- c. Ultrasonic Testing: ASTM E 164.
 - d. Radiographic Testing: ASTM E 94.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

3.4 PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
- 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION 05210

SECTION 05310 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Composite floor deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Evaluation Reports: For steel deck, from ICC-ES.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Profile, Depth, and Thickness: As indicated.
 - 3. Span Condition: Triple span or more.
 - 4. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), zinc coating.
2. Profile, Depth, and Thickness: As indicated.
3. Span Condition: Triple span or more.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth]
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Galvanizing Repair Paint: ASTM A 780/A 780M, SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions. See drawings for additional information and restrictions.

3.3 ROOF-DECK INSTALLATION

- A. Unless noted otherwise, fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Provide welds in each flute at all supports and end laps, unless noted otherwise. Space welds at longitudinal edges at same spacing as side-lap fasteners.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as required for diaphragm shear, using self-drilling No. 10-diameter or larger carbon steel screws, unless otherwise indicated. Use of mechanically clinched or button-punched side-laps shall provide equivalent diaphragm shear and deck deflection resistance as screwed side-lap design.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members as indicated on the drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 24 inches, and as follows, unless noted otherwise:
1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 2. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
1. End Joints: Butted.
- D. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- F. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

END OF SECTION 05310

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
3. Ceiling joist framing.
4. Soffit framing.

- B. Related Requirements:

1. Section 05500 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 09111 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

- C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of cold-formed metal framing product and accessory indicated.

- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Wall Framing: Horizontal deflection of:
 - 1) 1/360 of the wall height (non masonry backup).
 - 2) 1/600 of the wall height (masonry backup).
 - b. Interior Non-Load-Bearing Framing: Horizontal deflection of the following under a horizontal load of 5 lbf/sq. ft. (239 Pa):
 - 1) 1/360 of the wall height (non masonry backup).
 - 2) 1/600 of the wall height (masonry backup).

- c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1-inch.
 - 5. Design wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Wall Studs: AISI S211.
 - 2. Headers: AISI S212.
 - 3. Lateral Design: AISI S213.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60 (Z180), or equivalent.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs, minimum
 - 2. Flange Width: 1-1/4 inches (32 mm), minimum.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 - 3. Section Properties: As required by design.

- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Top Flange Width: 1-5/8 inches (41 mm), minimum.
 3. Section Properties: As required by design.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 1-5/8 inches (41 mm), minimum.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs or as required by design.
 2. Flange Width: 1-1/4 inches (32 mm) or as required by design.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 1-3/8 inches (35 mm), minimum.
 3. Section Properties: As required by design.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm), minimum.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 - b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched or punched with standard holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 - 3. Section Properties: As required by design.

2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 - 3. Section Properties: As required by design.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class .
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled expansion anchor, torque-controlled adhesive anchor, or adhesive anchor.

3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
- 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm) maximum and as required by design.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm) maximum and as required by design.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
5. Loose Steel Lintels
6. Metal Downspout Boots

- B. Related Sections:

1. Section 03300 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.
2. Section 05120 "Structural Steel."

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M.
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening cast iron.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- G. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

- K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09911 "Exterior Painting", Section 09912 "Interior Painting", Section 09960 "High-Performance Coatings".
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- H. Concrete: Comply with requirements in Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

J. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Lintels in Exterior Walls: Galvanize.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 09960 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 METAL DOWNSPOUT BOOTS

- A. Provide downspout boots made from ASTM A 48/A 48M Class 30 Gray iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
- B. Height: 32 inches overall. 24 inches exposed when installed.

- C. Cleanout: Manufacturer's standard side or front cleanout with cast iron cover, neoprene gasket and stainless steel tamper proof screws.
- D. Fasteners: Manufacturer's standard stainless steel fasteners for mounting onto building wall.
- E. Prime cast-iron downspout boots with manufacturer's standard primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Install pipe columns on concrete footings with grouted base plates. Position and grout column base plates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout base plates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09911 "Exterior Painting." and Section 09912 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05501 - METAL ROOF ACCESS LADDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior Steel Roof Access Ladders.
 - 2. Exterior Aluminum Roof-to-Roof Access Ladders.
- B. Products furnished, but not installed, under this Section:
 - 1. Anchor bolts indicated to be attached to concrete or masonry.
- C. Related Sections:
 - 1. Section 05120 "Structural Steel."
 - 2. Section 05500 "Metal Fabrications", including elevator pit ladder.
 - 3. Section 05511 "Metal Stairs."
 - 4. Section 05521 "Pipe and Tube Railings."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 2 (A4).
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- H. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- I. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.7 INTERIOR STEEL LADDERS

- A. General:
 1. Comply with ANSI A14.3 unless otherwise indicated.
- B. Steel Ladders:
 1. Space siderails 18 inches apart unless otherwise indicated.
 2. Space siderails of elevator pit ladders 12 inches (300 mm) apart.
 3. Siderails: Continuous, steel flat bars, with eased edges. Size as shown on the drawings.
 4. Rungs: 3/4-inch bars as shown on the drawings..
 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 8. Galvanize ladders, including brackets and fasteners.

2.8 EXTERIOR ALUMINUM LADDERS

A. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACL Industries, Inc.
 - b. Alco-Lite Industrial Products.
 - c. Halliday Products.
 - d. O'Keeffe's Inc.
 - e. Precision Ladders, LLC.
 - f. Royalite Manufacturing, Inc.
 - g. Thompson Fabricating, LLC.
2. Space siderails 18 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Provide platforms as indicated fabricated from extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 3/4 inch in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05511 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Preassembled steel stairs with concrete-filled treads.
- B. See Division 5 Section "Pipe and Tube Railings" for pipe and tube railings.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.
- B. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.3 SUBMITTALS

- A. Product Data: For metal stairs.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 COORDINATION

- A. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170).
- D. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1 (uncoated).

2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
- D. Welded Wire Fabric: ASTM A 185, 6 by 6 inches-W1.4 by W1.4, unless otherwise indicated.

2.3 FABRICATION

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed connections, finish exposed welds smooth and blended.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - 4. Form bent-metal corners to smallest radius possible without impairing work.
 - 5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
- B. Stair Framing: Fabricate stringers of steel as detailed. Construct platforms of steel plate or channel headers and miscellaneous framing members.
 - 1. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
1. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed products:
1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- D. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."
- E. Adjusting and Cleaning:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05511

SECTION 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum tube railings.
 - 2. Steel bar pickets.
- B. Related Requirements:
 - 1. Section 05512 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Steel Tube Railings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Wagner, R & B, Inc.](#)

B. Aluminum Tube Railings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [ATR Technologies, Inc.](#)
 - b. [Blum, Julius & Co., Inc.](#)
 - c. [Braun, J. G., Company.](#)
 - d. [CraneVeyor Corp.](#)
 - e. [Hollaender Manufacturing Company.](#)
 - f. [Kee Industrial Products, Inc.](#)
 - g. [Moultrie Manufacturing Company.](#)
 - h. [Sterling Dula Architectural Products, Inc.](#); Div. of Kane Manufacturing.
 - i. [Superior Aluminum Products, Inc.](#)
 - j. [Thompson Fabricating, LLC.](#)
 - k. [Tri Tech, Inc.](#)
 - l. [Tubular Specialties Manufacturing, Inc.](#)
 - m. [Tuttle Railing Systems.](#)
 - n. [Wagner, R & B, Inc.](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed or ASTM A 513).
- B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
- C. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- D. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
- E. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.6 FASTENERS

- A. General: Provide the following:
 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
 2. Aluminum Railings: Type 304 stainless-steel fasteners.
- B. Post-Installed Anchors: Torque-controlled expansion anchor capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 09912 "Interior Painting".
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- F. Form changes in direction by bending or by inserting prefabricated elbow fittings.

- G. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- H. Close exposed ends of railing members with prefabricated end fittings.
- I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

2.9 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Do not apply primer to galvanized surfaces.

2.10 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05521

SECTION 06105 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Framing with dimension lumber.
 2. Rooftop equipment bases and support curbs.
 3. Wood blocking, cants, and nailers.
 4. Wood furring and grounds.
 5. Plywood backing panels.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry, unless otherwise indicated, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - 3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat all miscellaneous carpentry, unless otherwise indicated.] [items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Roof construction.
 - 3. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent.
- B. Other Framing: Construction or No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
 7. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

- A. General: Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.
- C. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- D. Fasteners for pipe Soffits: Stainless Steel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Comply with AWPAs M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06105

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Plastic-laminate countertops, cabinets, shelving.
 - 2. Solid-surfacing-material countertops.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.

1.2 SUBMITTALS

- A. Product Data: For solid-surfacing material cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- D. Samples
 - 1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - 2. Plastic-laminates, for each type, color, pattern, and surface finish.
 - 3. Solid-surfacing materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of woodwork.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards."
 - 1. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.
 - 2. Contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (855-345-0991)

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood Products:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- B. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
- C. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on drawings.
- D. Certified Wood: Interior architectural woodwork shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWWA C20 (lumber) and AWWA C27 (plywood). Use Exterior Type of Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 8 Section.

- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
 - 1. Finish: Satin Stainless Steel.
- D. Catches: Magnetic catches, BHMA A156.9, B03141.
- E. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; type; zinc-plated steel ball-bearing slides.
- F. Door Locks: BHMA A156.11, E07121.
- G. Drawer Locks: BHMA A156.11, E07041.
- H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- I. Adjustable Shelf Supports: 1/4-inch diameter angular, with riveted pin, nickel-plated steel.
 - 1. Hafele model 282.11.761 or Double pin locking shelf support made of translucent polycarbonate meeting Grade 3 requirement per ANSI/BHMA specification. Minimum 300 lb load limit.
- J. Grommets for Cable Passage through Countertops: 2-inch (51 mm) stainless steel with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide Doug Mockett & Company, Inc. or equal.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.
- B. Adhesives, General: Adhesives shall not contain urea formaldehyde.
- C. VOC Limits for Installation Adhesives: Installation adhesives shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Handrail Brackets: As detailed. Sized to provide 1-1/2 inch (38-mm) clearance between handrail and wall.

2.5 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 1. Interior Woodwork Grade: Premium.

B. Plastic-Laminate Cabinets, Countertops, Shelving:

1. AWI Type of Cabinet Construction: As indicated.
2. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
 - a. Horizontal Surfaces Other Than Tops: Grade HGS.
 - b. Vertical Surfaces: Grade VGS.
 - c. Edges: Grade HGS or 3mm PVC
3. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS. Shelving: High pressure Decorative laminate grade: HGS.
4. Drawer Sides and Backs: Solid-hardwood lumber or 3/4" thermofused covered particle board.
5. Drawer Bottoms: Hardwood plywood or 1/4" medium density fiberboard with thermofused laminate.
6. Colors, Patterns, and Finishes: As indicated on drawings.
7. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

C. Solid-Surfacing-Material Countertops:

1. Solid-Surfacing-Material Thickness: As detailed.
2. Colors, Patterns, and Finishes: As indicated on drawings.
3. Fabricate tops in one piece. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.
- B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Shim as required with concealed shims.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
 - 1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

END OF SECTION 06402

SECTION 07141 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyurethane waterproofing.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

B. Shop Drawings:

1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Sample warranty.

1.5 QUALITY ASSURANCE

- ##### A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 WARRANTY

- ##### A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: [ASTM C 836/C 836M] [and] [coal-tar free].
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals, LLC, Building Systems; Sonoshield HLM 5000.
 - b. Carlisle Coatings & Waterproofing Inc; MiraSEAL.
 - c. Neogard; Neogard 7401.
 - d. Polyguard Products, Inc; Polyguard PG-250.
 - e. Tremco Incorporated; TREMproof 250 GC.
 - f. United Coatings; Elastall 1000.

2.2 AUXILIARY MATERIALS

- A. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.
- B. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.
 - 1. Adhesive: Manufacturer's recommended contact adhesive.
- C. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric.
- D. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
- E. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.
 - 1. Backer Rod: Closed-cell polyethylene foam.

2.3 PROTECTION COURSE

- A. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Henry Company; Asphalt Protection Board.
 - b. Soprema, Inc; Sopraboard.
 - c. W. R. Meadows, Inc; Protection Course.
 - 2. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - 3. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

- B. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side with plastic film, nominal thickness of 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) according to ASTM D 1621 and maximum water absorption by volume of 0.6 percent according to ASTM C 272.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Protection Board III.
- C. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on both sides with plastic film, nominal thickness of 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) according to ASTM D 1621 and maximum water absorption by volume of 0.6 percent according to ASTM C 272.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Owens Corning Insulating Systems LLC; Fanfold DWB.
 - b. Pactiv Corporation; GreenGuard PB4.
 - c. Urethane Polymers International, Inc; UPI-PB4.
- D. Protection Course: Extruded-polystyrene board insulation with continuous surface skins on both faces intact, unfaced; ASTM C 578, Type X, 1/2 inch (13 mm) thick.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Owens Corning Insulating Systems LLC; Foamular Half-Inch.
- E. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in [ASTM C 898/C 898M] [and] [ASTM C 1471].
- G. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.
- H. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in [ASTM C 898/C 898M] [and] [ASTM C 1471]. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
- I. Install sheet flashing and bond to deck and wall substrates where required according to waterproofing manufacturer's written instructions.

3.2 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in [ASTM C 898/C 898M] [and] [ASTM C 1471].
- B. Unreinforced Waterproofing Applications:
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 120 mils (3 mm).
- C. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
 - 1. For horizontal applications, install protection course loose laid over fully cured membrane.
 - 2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
 - 3. [Molded-sheet drainage panels] [Insulation drainage panels] [Board insulation] may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

3.3 PROTECTION

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07141

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation at foundation walls.
2. Unfaced fiberglass blanket concealed insulation.
3. Unfaced fire safing mineral wool blanket insulation.
4. Mineral-wool board insulation.
5. Vapor barriers on interior side of exterior framed walls and ceilings.

B. Related Sections: The following section contains requirements that relate to this section:

1. Section 09250 Gypsum Board for Sound Attenuation Blankets

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product test reports.
- C. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Plymouth Foam, Inc.
2. Type VIII, 20 psi.

2.2 FIBERGLASS BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Fibrex Insulations Inc.
 2. Owens Corning.
 3. Roxul Inc.
 4. Thermafiber.
- B. Unfaced Fiberglass Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing), consisting of fibers; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 FIRE SAFING MINERAL-WOOL BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Fibrex Insulations Inc.
 2. Roxul Inc.
 3. Thermafiber.
- B. Unfaced Mineral-Wool Blanket Insulation: ASTM C 665, Type I, (blankets without membrane facing); consisting of fibers; with maximum flame spread and smoke developed indexes of 0 and 0, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.4 MINERAL-WOOL BOARD

- A. Mineral-Wool Board, Type IVA, Curtainwall Insulation: ASTM C 612, Type IVA; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 4 lb/cu. ft. (64 kg/cu. m).
- B. Mineral-Wool Board, Type II, Unfaced Rainscreen Insulation: ASTM C 612, Type II; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 6 lb/cu. ft. (96 kg/cu. m).

2.5 VAPOR BARRIERS

- A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft. (9 kg/100 sq. m), with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
 - 1. Lamtec WMP-10 or approved equal.
 - 2. Application: At exterior metal studs walls, install on the interior face of the metal studs behind the interior gypsum board.
- B. Vapor-Barrier Tape: Pressure-sensitive tape of type recommended by vapor-barrier manufacturer for sealing joints and penetrations in vapor barrier.
- C. Insulation/Air Barrier Foam: Froth-Pak foamed-in-place insulating air barrier sealant as manufactured by Insta-Foam Products, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.
- B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches from exterior walls.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 - 2. Install insulation to fit snugly without bowing.

3.6 INSTALLATION OF POLYETHELENE VAPOR BARRIER

- A. Extend vapor barrier over metal-framing to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor barrier to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
 - 1. Set vapor-barrier to warm side of exterior wall construction, unless otherwise indicated.
 - a. Tape joints and ruptures in vapor retarder, and seal each continuous area of vapor barrier to surrounding construction to ensure airtight installation.
 - b. Install insulation/air barrier foam at penetrations of vapor-retarder membrane.
 - 2. Seal vertical joints in vapor barriers over framing by lapping not less than two wall studs. Fasten vapor barriers to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
 - 3. Seal overlapping joints in vapor barriers with adhesives or vapor-retarder tape according to vapor-barrier tape. Locate all joints over framing members or other solid substrates.
 - 4. Firmly attach vapor barriers to substrates with mechanical fasteners or adhesives as recommended by vapor-barrier manufacturer.
 - 5. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier tape to create an airtight seal between penetrating objects and vapor barrier.
 - 6. Repair any tears or punctures in vapor barriers immediately before concealment by other work. Cover with vapor-barrier tape or another layer of vapor barrier.

3.7 PROTECTION

- A. Protect installed insulation and vapor barriers from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07221 - ROOF BOARD INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Base layer insulation, tapered cricket insulation and secondary/cover board insulation.

B. Related Sections include the following:

1. Section 06105 "Miscellaneous Carpentry"

2. Section 07550 "Modified Bituminous Membrane Roofing".

3. Section 07620 "Sheet Metal Flashing and Trim".

1.3 REFERENCES

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

B. Standards:

1. FM Global Approval Guide

2. Underwriters Laboratories: Building Materials Directory.

3. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual.

C. ASCE 7-10: "Minimum Design Loads for Buildings and Other Structures".

D. Polyisocyanurate Insulation Manufacturer's Association: Technical Bulletin 109 – "Storage and Handling Recommendations for Polyisocyanurate".

1.4 SUBMITTALS

A. Product Data: submit manufacturer's product data sheets, providing descriptive data, dimensions, LTTR values, and other pertinent criteria for each material proposed for use in construction of roof assembly.

B. Samples: Provide physical examples of materials/components proposed for use to compromise the specified roof system.

1.5 QUALITY ASSURANCE

A. Requirements:

1. Classified by Underwriters Laboratories Inc as Class A rated material.

2. Follow local, state and federal regulations, safety standards and codes. When conflict exists, the more restrictive document shall govern.

B. Installation:

1. Install in accordance with manufacturer's current published application procedures, general requirements of NRCA, and as supplemented by these documents.

2. Consider roof system manufacturer's technical specifications part of this Specification and use as reference for specific application procedures.

3. Install roof system in accordance with prime roof material manufacturer's technical departments uplift calculations and attachment requirements. Negative pressures shall be based on ASCE 7-10.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store materials in accordance with manufacturer's recommendations.
- B. Outdoor Storage:
 - 1. Tarp and shield insulation from moisture and exposure to sun.
 - 2. Elevate insulation above substrate 4-inches minimum.
 - 3. Secure insulation to resist winds.
 - 4. Do not use insulation which has been determined "wet" or which has been wet and has dried.
 - 5. Distribute insulation stored on roof deck to prevent concentrated loads that would impose excessive stress or strain on deck and structural members or impede drainage.

1.7 SEQUENCING AND SCHEDULING

- A. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing.
- B. Do not install more insulation than can be made watertight in same day.

1.8 PROJECT CONDITIONS

- A. Environmental recommendations:
 - 1. Apply roofing and insulation in dry weather.
 - 2. Do not proceed with roof construction during inclement weather or when precipitation is predicted with 30 percent or higher probability.
 - 3. Do not apply insulation over wet or moist deck or in foggy conditions.
 - 4. Wind speeds in excess of 30 mph shall constitute "Inclement Weather".
- B. Maintain on-site equipment and material necessary to apply emergency temporary weather protection to incomplete work in event of sudden or unexpected precipitation.

PART 2 PRODUCTS

2.1 ROOF INSULATION

- A. Tapered Insulation: Rigid, closed cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic organic fiberglass facers, ASTM C 1289, Type II, Class 1, Grade 2 (20 psi), tapered 1/8" per foot: "Tapered ACFoam-II" by Atlas Roofing Corporation or pre-approved equal.
- B. Secondary Insulation Layer/Cover Board: Moisture resistant, 1/2-inch thick gypsum roof board, ASTM C 1278; provide 48" by 48" nominal size: "DensDeck Prime" by Georgia Pacific or pre-approved equal.
- C. Tapered Edge Strip: Tapered perlite complying with ASTM C 728.

2.2 RELATED MATERIALS

- A. Heat Resistant Insulation: Molded hydrous calcium silicate-based or perlite-based heat resistant rigid pipe insulation, 2-inches in thickness and sized for installation around circular/tubular element: "Sproule Pipe Insulation" or "Thermo-12 Gold" by Industrial Insulation Group or pre-approved equal.
- B. Compressible Fill Insulation: Foil or paper-faced compressible fiberglass batten roll insulation of proper size and thickness to insert at openings at penetrations, perimeters, and curbs: Manufactured by Owens Corning or pre-approved equal.

- C. Cant Strips: Inorganic fibrous glass, dimensionally stable and fire resistant with 3-5/8" face. "Glass Cant" by The Garland Co., Inc. or pre-approved equal.
- D. Low-Rise Foam Insulation Adhesive:
 - 1. Dual-component, VOC compliant, two-part reaction-cure urethane foam adhesive.
 - a. "Insul-Lock HR" by The Garland Co., Inc.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Roof system manufacturer's representative shall inspect roof deck and associated substrates and provide written acceptance of conditions.
- B. Manufacturer's approved roofing contractor shall inspect and approve deck and substrates.
- C. Roofing contractor shall examine roof deck and related substrates and verify that there are no conditions that would prevent roof system manufacturer's approved application of roof system. These conditions include, but are not limited to, the following:
 - 1. Inadequate support or anchorage of decking or substrates to structure.
 - 2. Accumulations of moisture.
 - 3. Tears, holes, or punctures.
 - 4. Ridges, uneven conditions, or gaps.
 - 5. Rust or other forms of deterioration.
 - 6. Presence of foreign materials.
- D. Start of work constitutes acceptance of substrate and site conditions.

3.2 PROTECTION

- A. Provide special protection from traffic on yet to be removed roofing and newly installed roof materials.

3.3 APPLICATION

- A. General:
 - 1. Install insulation to achieve positive drainage across the roof deck in general accordance with manufacturer's guidelines.
 - 2. Stagger end joints of insulation boards 1/2 of overall length of board.
 - 3. Butt joints tightly allowing no more than 1/4-inch wide gaps between units. Fill joints between adjacent boards with like insulation or foam adhesive.
 - 4. Do not use warped, bent or otherwise damaged insulation boards.
 - 5. Field cut and fit insulation at penetrations, curbs, and walls.
 - 6. Stagger all joints (side and end) between layers of insulation.
 - 7. Field cut tapered insulation boards to create crickets at upslope sides of curbs and along walls to achieve a minimum resulting roof slope of 1/4" per foot.
 - 8. Install tapered edge strips at changes in elevations, edge of crickets and other locations to create a monolithic and uniform substrate for installation of roofing membrane.
- B. Adhered Layers of Insulation:
 - 1. Adhere tapered insulation layer and cover board to base insulation layer.
 - 2. Stagger end joints of insulation boards 1/2 of overall length of board. Stagger joints of subsequent insulation layers from underlying insulation layer.
 - 3. Butt joints of insulation layers tightly allowing no more than 1/4-inch wide gaps between units. Fill joints or gaps greater than 1/8-inch between adjacent boards with low-rise foam adhesive.

4. Do not use warped, bent, or otherwise damaged insulation boards. Discard damaged boards.
 5. Field cut and fit insulation boards at penetrations, curbs, and walls. Field cut tapered insulation boards to create crickets at upslope sides of curbs and along walls.
 6. Install cover board over insulation in accordance with manufacturer's guidelines.
- C. Ribbon Application (Urethane Foam Insulation Adhesive):
1. Dispense 1/2-inch wide continuous ribbons of adhesive on substrate to adhere insulation board.
 2. Place the initial ribbon of adhesive 3-inches inside each edge/side of the insulation board in a picture-frame fashion. Apply additional parallel ribbons of adhesive across the remainder of the board in a serpentine fashion and spaced according to roof membrane manufacturer's ASCE 7-10 calculations.
 3. Firmly set insulation boards in the ribbons of foam adhesive following application of the adhesive when adhesive has risen to proper height and walk-in the insulation to spread the adhesive ribbons, ensuring maximum contact. Do not push or slide insulation into position. Set weighted objects on ends, sides, and corners of boards until adhesive has set and insulation is firmly attached.
 4. On additional insulation layers, dispense ribbons of adhesive in direction perpendicular to the direction of the beads that were dispensed on the underlying layer.
 5. Fill voids or open joints in top layer of insulation with spray-foam adhesive to provide monolithic surface to receive new membrane.
 6. Adhere partial boards and tapered edge strips with adhesive ribbon positioned in picture-frame fashion along perimeter of board and remaining adhesive ribbons spaced in accordance with location on roof (field, perimeter, corner).
 7. At end of each work day, provide staggered ends of installed boards so that proper joint stagger can be achieved on following roof installation.
- D. Heat Exhaust Vents:
1. Install heat resistant insulation around existing heat exhaust flue, vent pipes, or other penetrations that experience elevated operating temperature.
 2. Install new sheet metal base around insulation and strip flange into new roof.
- E. Insulation Filler: Install compressible fiberglass insulation at openings in deck at penetrations, perimeters, expansion joints, and/or curbs.
- F. Drains:
1. Insulation shall be sumped in a perimeter at all drains a minimum of double the slope of the finished roof.

3.4 CLEANING

- A. Remove debris and material wrappers from roof to dumpster daily. Leave insulation clean, dry, and ready to receive new roofing.

3.5 ADJUSTING

- A. Remove damaged insulation and install acceptable new units before installation of roof membrane system.

END OF SECTION 07221

SECTION 07241 – POLYMER-BASED EXTERIOR FINISH SYSTEM (EFS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior finish system (EFS) applied over the following:
 - a. Gypsum Sheathing
- B. Related Sections include the following:
 - 1. Division 6 Section "Sheathing"

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For EFS and for each color and texture required.
- C. Product test reports required by the local building authorities.
- D. Research/evaluation reports.
- E. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer, certified by manufacturer to install manufacturer's products.
- B. Fire-Test-Response Characteristics: Determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting agency.
 - 1. Finish Coats: Flame-spread and smoke-developed indices of not more than 25 and 450, respectively, when tested individually per ASTM E 84.
 - 2. Full-Scale Fire Test: Tested mockup shows no tendency to propagate flame over the surface or through finish to core, or to cause delamination of finish when vertically

mounted exterior face is exposed 15 minutes to a fire source using flame-spread test per ASTM E 108 modified as indicated for testing vertical walls.

- C. Preinstallation Conference: Attend conference at Project site.

1.5 COORDINATION

- A. Coordinate installation of EFS with related Work specified in other Sections to ensure that ceiling assemblies, including flashing, trim, joint sealants, light fixtures and similar items are protected against damage from the effects of weather, age, corrosion, moisture, and other causes.

PART 2 - PRODUCTS

2.1 CLASS PB EXTERIOR FINISH SYSTEMS

- A. Basis-of-Design Product: The design for EFS is based on Senergy Senerflex Lamina Direct Finish System for Soffits and Ceilings System as manufactured by Degussa Wall Systems, Inc.
 - 1. Equal products from Sto Corp and Dryvit will be acceptable.
- B. Class PB Exterior Finish System: As defined in ASTM PS 49, non-load-bearing, exterior wall cladding system that consists of integrally reinforced base coat; and texture protective finish coat.
- C. Physical Properties: Exterior finish system complying with performance characteristics in "EIMA Guideline Specification for Exterior Insulation and Finish Systems, Class PB."
- D. Compatibility: Provide substrates, adhesive, sealants, and accessories that are compatible with one another and EIFS system and approved for use by system manufacturer.
- E. Primer/Sealer: Substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of the EFS system.
- F. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof mixture complying with requirements for material composition and method of combining materials.
- G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave glass-fiber mesh treated for compatibility with other EIFS materials and complying with EIMA 105.01 and ASTM D 578.
 - 1. Intermediate-Impact Reinforcing Mesh: Not less than 12.0 oz./sq. yd.
 - 2. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
 - 3. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 - 4. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
- H. Base-Coat Materials: Manufacturer's standard.

- I. Finish-Coat Materials: Factory-mixed polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 1. Texture: Sandpebble Fine.
 2. Color: To be selected by Architect from manufacturer's full range.

2.2 ELASTOMERIC SEALANTS

- A. Elastomeric Sealant Products: System manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB."
 1. Comply with requirements in Division 7 Section "Joint Sealants" for low-modulus silicone sealant.
- B. Sealant Color: Match finish-coat color of system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.
- B. Examine soffit edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EFS INSTALLATION

- A. General: Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.
- B. Primer/Sealer: Apply over gypsum sheathing and cementitious backer board substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- C. Waterproof Adhesive/Base Coat:
 1. At soffits and walls apply basecoat over substrates to protect substrates from degradation.
- D. Expansion Joints: Install at locations indicated; where required by EFS manufacturer; where expansion joints are indicated in substrates behind EFS; where EFS adjoin dissimilar substrates, materials, and construction and where wall height changes.
 1. Space expansion/control joints at 16' o.c. maximum

- E. System Installation: Comply with ASTM PS 49 and system manufacturer's written instructions.
- F. Apply base coat to exposed surfaces of substrate in minimum thickness recommended in writing by system manufacturer, but not less than 1/8-inch dry-coat thickness.
- G. Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM PS 49 and system manufacturer's written requirements. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
- H. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide strip reinforcing mesh at both inside and outside corners, unless base layer of mesh is lapped not less than 4 inches on each side of corners.
 - 1. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- I. Apply finish coat over dry base coat maintaining a wet edge at all times for uniform appearance, in thickness required by system manufacturer to produce uniform finish of color and texture matching approved sample.
- J. Joint-Sealant Installation:
 - 1. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 7 Section "Joint Sealants" and in "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB."

END OF SECTION 07241

SECTION 07242 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad barrier-wall assemblies that are field applied over substrate.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each EIFS component, trim, and accessory.

- ##### B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Manufacturer certificates.

- ##### B. Product certificates.

- ##### C. Product test reports.

- ##### D. Field quality-control reports.

- ##### E. Evaluation Reports: For EIFS, including insulation fasteners, flexible membrane flashing, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- ##### A. Maintenance data.

1.6 QUALITY ASSURANCE

- ##### A. Installer Qualifications: An installer certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Sto Corp.
 - 2. Dryvit.
 - 3. Senergy.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:
 - 1. Weathertightness: Resistant to water penetration from exterior.
 - 2. Impact Performance: ASTM E 2568, High impact resistance unless otherwise indicated.
 - 3. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.

2.3 EIFS MATERIALS

- A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

- C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate.
- D. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation (EPS): Comply with ASTM C 578, Type I.
 - 1. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E 2098.
- F. Base-Coat Materials: EIFS manufacturer's standard mixture.
- G. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation.
- H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- I. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating.
 - 1. Texture: Sandpebble.
 - 2. Color: To be selected by Architect from manufacturer's full range.
- J. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784 and ASTM C 1063.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

- A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.
- B. Primer/Sealer: Apply over gypsum sheathing and concrete masonry unit substrates and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- C. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.
- D. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints and elsewhere as indicated. Coordinate with installation of insulation.
- E. Board Insulation: Adhesively attach insulation to substrate.
 - 1. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

- F. Expansion Joints: Install at locations indicated and where required by EIFS manufacturer.
- G. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than [1/16-inch (1.6-mm) dry-coat thickness.
- H. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- I. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- J. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
- K. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.
- L. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.2 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: According to ASTM E 2568.
- D. EIFS will be considered defective if it does not pass tests and inspections.

END OF SECTION 07241

SECTION 07272 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Fluid-applied air and water barrier membrane, non- vapor retarding.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous non vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
- C. Product certificates.
- D. Qualification data.
- E. Product test reports.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED AIR BARRIER MEMBRANE

- A. Fluid-Applied, Non-Vapor-Retarding Air Barrier Membrane: Elastomeric, modified bituminous or synthetic polymer membrane.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Elastomeric Modified Bituminous Membrane:
 - 1) Henry Company; Air-Bloc 07.
 - 2) Meadows, W. R., Inc.; Air-Shield LMP.
 - 3) Tremco Incorporated; ExoAir 220R.
 - 4) Hohman and Barnard, Inc. Textroflash Liquid VP.
 - b. Synthetic Polymer Membrane:
 - 1) Carlisle Coatings and Waterproofing, Inc. Barritech VP.
 - 2) Grace, W. R. & Co.; Perm-A-Barrier VP.
 - 3) Henry Company; Air-Bloc 31.
 - 4) Rubber Polymer Corporation; Rub-R-Wall Airtight VP.
 - 5) Tremco, Incorporated: ExoAir 230.
 - 6) Prosoco (R Guard MVP)
 - 7) GE/Momentive: Elemax 2600
 2. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.
- C. Butyl Strip: Vapor-retarding, 30- to 40-mil- (0.76- to 1.0-mm-) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

- D. Modified Bituminous Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
- F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- H. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- I. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43-mm-) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms (2145 ng/Pa x s x sq. m).
- J. Elastomeric Flashing Sheet (under windows & sometimes at jambs): ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- (1.3- to 1.6-mm-) thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners, aluminum termination bars and stainless-steel fasteners, or galvanized steel termination bars and fasteners.
- K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
- L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 7 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions.

3.2 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip, adhesive-coated transition strip, elastomeric flashing sheet, or preformed silicone-sealant extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.3 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
1. Apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air barrier membrane in full contact around protrusions such as masonry ties.
 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil (1.0-mm) dry film thickness applied in one or more equal coats.
- C. Apply strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements.
- C. Tests: Testing to be performed will be determined by Owner's testing agency as follows:
 1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization .
- D. Remove and replace deficient air barrier components and retest as specified above.

3.5 PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.

END OF SECTION 07272

SECTION 07420 - ALUMINUM COMPOSITE PANEL SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor and materials necessary to complete all aluminum composite building panels indicated on the project drawings and as specified herein.
- B. Composite building panels are hereby defined as the composite aluminum panels including the UNIVERSE® 2000 Attachment System utilizing IntelliClad® methodology as supplied by Universe® Corporation, St. Louis, MO. (314-439-2800) www.universecorp.com or contact@universecorp.com , based on design and tested criteria.
- C. An approved equal will be considered.
- D. The work of this section consists of all work as shown on drawings.
- E. Sealant for a complete panel system shall be a part of this section. Sealant type to be as recommended by the panel system fabricator, supplied and installed by the panel installer. Color to be selected by architect from manufacturer's standard color selector card. All metal surfaces to be primed per recommendations and instructions of sealant manufacturer prior to sealant installation.
- F. Metal stud framing and furring (18-gauge minimum) as may be required for the support of the panel wall is to be supplied and installed under the related specification.

1.2 RELATED WORK UNDER OTHER SECTIONS

- A. The following items of related work, specified in other sections, are not included.
 - 1. Structural Steel.
 - 2. Metal Stud Framing System.
 - 3. Gypsum Wallboard Systems.
 - 4. Flashings.
 - 5. Glass and Glazing.
 - 6. Insulation and Safing.
 - 7. Sealants, except as noted in 1.02.E. above.

1.3 SUBMITTALS

- A. Shop Drawings: Submit complete shop drawings, with drawing submittals done in a CAD format utilizing IntelliClad® methodology of all work of this section through the general contractor for approval, including large scale details of construction and showing method of installation and attachment to the building's supporting structure.
- B. Submit samples of typical aluminum composite panels, of type, thickness and finish specified.

- C. Submit panel manufacturer's product data, consisting of complete product description and specification.
- D. Submit panel system fabricator's installation manual, indicating the procedures to be followed by the installer in forming, sealing and installing the attachment system.

1.4 PERFORMANCE

This is a performance specification; panel systems that are not in compliance with the required performance standards listed herein are unacceptable. Note: The listing of a product name, system, or fabricator does not constitute approval unless all performance criteria are met. If the product bid does not comply with the criteria required, the bidder shall compensate the architect for additional time spent to review the non-compliant material and any additional design costs incurred.

- A. Provide a composite building panel system which has been pretested by an independent testing laboratory to provide specified resistance to air and water infiltration and structural deflection, when installed. Systems that are not pretested and certified by an independent laboratory prior to bid are unacceptable. The use of a panel manufacturer's generic tests reports are unacceptable; the tests must be for the specific system submitted by the panel system engineer and fabricator.
- B. Structural Deflection: Deflection of perimeter framing members shall not exceed L/175 of span length or 3/4 inches, whichever is less; or there shall be no permanent set in excess of .100 inches.
- C. Performance Test Standards:
 - 1. Static Air Infiltration (ASTM E283-84) at 10.0 psf (63.3 mph wind and 1.92" H₂O). Air infiltration shall not exceed .06 cfm per square foot for the fixed wall.
 - 2. Static Water Infiltration (ASTM E331-83) at 15.0 psf (77.5 mph wind and 2.88" H₂O) with a water spray rate of five (5) gallons per hour per square foot minimum for 15 minutes, no uncontrolled water infiltration on roomside.
 - 3. Structural Performance (ASTM E330) shall be tested in accordance with a design pressure of 40 psf. Deflection limitations as listed previously (1.05.B). After initial test, test at 150% of design pressure. No permanent deformation exceeding L/1000 or failure to structural members allowed.
 - 4. Fire Performance Characteristics:
Provide test report on the panel material in accordance with the following:
 - a. ASTM-E84
 - b. ASTM-E108, Modified

1.5 QUALITY ASSURANCE

- A. The panel system fabricator shall be approved by the panel manufacturer.
- B. Panel system fabricator shall have a minimum of ten (10) years experience.

- C. The panel system installer shall be responsible for a complete, sealed and weathertight installation.
- D. The panel system fabricator will prepare the shop drawings in accordance with their standard published product data and criteria established by others. The general contractor and subcontractor shall be responsible to verify the information contained therein including all dimensions.

In the interest of maintaining job schedules, the panel system fabricator will fabricate all of the materials from the approved set of shop drawings. If field verification of dimensions are required, the general contractor/subcontractor shall be responsible to supply these dimensions to the panel system fabricator prior to engineering/fabricating of the materials. Discrepancies found during field verification shall be corrected by the general contractor at no cost to the panel system fabricator.

1.6 PRODUCT DELIVERY, STORAGE & HANDLING

- A. All materials under this section shall be packaged, boxed, wrapped, or otherwise protected to assure complete protection from damage during shipment.
- B. Materials shall be stored in interior spaces or above ground under protective and ventilated covers.
- C. The subcontractor shall be responsible for proper storage and handling. Extra protective measures shall be taken to assure that panel edges are secured from damage at all times.

1.7 COORDINATION

- A. The general contractor and subcontractor responsible for the work of this section shall coordinate the work of this section with work of other trades affecting, or affected by, this work to assure the steady progress of all the work of the contract
- B. Before proceeding with installation, the general contractor shall require the installer to inspect all project conditions affecting the work of this section to assure that all such conditions and work are suitable to satisfactorily receive the work of this section.

1.8 WARRANTY

- A. The panel system manufacturer will warrant that the system it supplies will be free from defects in materials and workmanship for a period of three (3) years.
- B. The aluminum composite material manufacturer (sheet stock) will provide its standard product warranty.
- C. The finish warranty will vary depending on the finish supplied and/or the paint color selected, but will generally follow the guidelines below:

-	Chalk, Peel, Crack or Check	10 years
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- Fade (will vary by color selection and jobsite environment) 10 years

PART 2 – PRODUCTS

2.1 ACCEPTABLE COMPOSITE PANEL MANUFACTURERS

- A. Alucobond® by Alcan Composites, Inc., St. Louis, MO.
- B. Alpollic® by Mitsubishi Chemical America, Inc., Chesapeake, VA.

2.2 MATERIALS

- A. The drawings and specifications are based on composite metal facing panels with non-progressive, mechanical/ sealant type attachment method.
- B. Composition: Two sheets of .020 aluminum sandwiching a core of extruded thermoplastic formed in a continuous process with no glues or adhesives between dissimilar materials. Core material to be polyethylene (PE) unless noted otherwise. Laminated panels are not acceptable. Preferred total thickness of panel shall be 6mm (approx. ¼").
- C. Finish:
 - 1. Kynar metallic finish to be selected by Architect from manufacturer's full range.

2.3 PANEL SYSTEM PERFORMANCE REQUIREMENTS

- A. The panel system is to be of a rout and return configuration utilizing a continuous aluminum extrusion attachment system.

Attachment methods using clips attached with fasteners through the panel's return flange will not be allowed.
- B. The aluminum composite panel attachment system shall be thermally broken and incorporate the necessary thermal expansion and contraction movements within the confines of the attachment mechanism surrounding each panel without the use of any metal to metal sliding joints.
- C. The attachment system shall allow for removal of any individual panel within the erected system for damage replacement or access to structure behind the panel, without disturbing adjacent panels. The removed panel must be put into the original tested attachment system.
- D. Panel system to be field sealed between panels with silicone materials as specified in the related specification.
- E. Detail and fabricate panels to the sizes, configurations and layouts as shown on the approved shop drawings. Panel system fabricator's shop drawings will provide for flat panel surfaces within the tolerances and performance requirements of the panel manufacturer.

- F. Fabricate all materials in accordance with the approved shop drawings. However, if field measurements are required, they will be supplied to the panel fabricator by others at no expense to the panel fabricator. All schedules will be based on the later occurrence, shop drawing approval or approval of field measurements.
- G. Grain pattern of anodized and metallic finished aluminum facing sheets to run in same direction, unless otherwise specified.
- H. Panels shall be marked to coordinate with the approved shop drawings.
- I. Provide protective film on exposed panel faces and leave in place during fabrication.

PART 3. – EXECUTION

3.1 PREPARATION

- A. Installer shall examine all surfaces and conditions which the work of this section is to be applied and notify the general contractor, in writing, of any defects which would be detrimental to proper installation and alignment of the work. No work shall be erected until all discrepancies have been resolved. Application of materials constitutes acceptance of subsurfaces and conditions.

3.2 INSTALLATION

- A. Typically, all aluminum composite panels will be shipped flat with all sides completely fabricated and notched ready for field forming and installation.
- B. Install composite metal panel system in accordance with the panel system fabricator's approved shop drawings and as illustrated in the fabricator's panel system "Installation Instruction Manual".
- C. Erect and securely anchor all panels plumb, level, square and true to line in accordance with approved shop drawings. Metal grain of panels to be installed in same direction on anodized and metallic finished material, unless otherwise noted on the approved shop drawings.
- D. Tolerances: Maximum deviation from vertical and horizontal alignment of erected panels shall not exceed 1/8" inch per 12 foot length of any member, or 1/4" in any total run in any line.
- E. Use concealed fastening system of non-corrosive type fasteners as recommended by the panel systems manufacturer. These fasteners to occur under all sealant joints. No exposed, visible fasteners are permitted.
- F. Provide for necessary structural movement as indicated on the approved shop drawings.
- G. Sealant at all panel joints to be installed as part of the related specifications.
 - 1. Installer to prime metal surfaces as recommended by sealant manufacturer. Install sealant in accordance with sealant manufacturer's recommendations. Finished sealant joints to have clean edges.

- H. Remove protective film from panel faces immediately upon completion of panel installation.

3.3 PANEL ATTACHMENT SYSTEM

- A. Attachment system includes:

1. Fabricated composite metal panels.
2. Attachment System.
3. Protective film one (1) side of panels.

- B. Attachment system does not include:

1. Flashings.
2. Stud framing members required for panel systems support.
3. Insulation.
4. Wood blocking, furring.
5. Sheathing and gypsum drywall.
6. Sealant and primers.

- C. Attachment System to freely allow thermal movement of each panel.

1. Fasteners into or attached to panels are not permitted.
2. Metal to metal sliding joints are not permitted.
3. Panels to use a continuous perimeter extrusion in a rout and return configuration.

- D. Vapor Barrier

The designed system is a wet sealed weather tight system, without weeps. The building envelope shall include a continuous vapor barrier system to prevent conditioned air from reaching the interior panel surfaces and forming condensation.

- E. Panel Removal

1. Panels are to be removable from the exterior without disturbing adjacent panels and are to be reinstalled with the original installation method, so the tested performance is assured.

- F. Sealant Joints

1. Joint width to be as noted on drawings.
2. All metal surfaces to be primed per recommendations of sealant manufacturer.

- G. Panel Protection

1. Panels to be covered with a protective film during fabrication and erection.
2. Film is to be removed immediately after panel installation. Final cleaning and protection then becomes the responsibility of the general contractor.

- H. Fasteners

1. Fasteners exposed to atmosphere to be stainless steel or equal.

I. Installation

1. Panel installation to be performed by workers experienced with commercial panel installation.
2. Sealant to be installed by the same workmen as above or independent caulking contractor.

3.5 GLAZING SYSTEM

- A. See Section 08800 - Glazing for coordination of this work.

3.6 CLEAN-UP

- A. Upon completion, remove and legally dispose of all trash and debris resulting from operations of this section.

END OF SECTION 07420

SECTION 07550 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cold Applied 2-Ply Thermoplastic Hybrid Roof System (KEE-Stone FB 60). (2.17)(3.4)
- B. Accessories. (2.19)
- C. Edge Treatment and Roof Penetration Flashings. (2.20)(3.9)

1.2 RELATED SECTIONS

- A. Section 05300 - Metal Roof Deck.
- B. Section 06105 - Miscellaneous Carpentry.
- C. Section 07220 - Roof Board Insulation: Insulation and fastening.
- D. Section 07620 - Sheet Metal Flashing and Trim: Weather protection for base flashings.

1.3 REFERENCES

- A. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- B. ASTM D 312 - Standard Specification for Asphalt used in Roofing.
- C. ASTM D 451 - Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
- D. ASTM D 1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.
- E. ASTM D 1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
- F. ASTM D 1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- G. ASTM D 1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.
- H. ASTM D 2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- I. ASTM D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
- J. ASTM D 4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- K. ASTM D 4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
- L. ASTM D 5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.

- M. ASTM D 6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
- N. ASTM D 6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
- O. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- P. ASTM D 6754 - Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing.
- Q. ASTM D 6757 - Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing.
- R. ASTM E 108 - Standard Test Methods for Fire Test of Roof Coverings
- S. Factory Mutual Research (FM): Roof Assembly Classifications.
- T. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- U. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- V. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
- W. Warnock Hersey (WH): Fire Hazard Classifications.
- X. ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
- Y. ASCE 7, Minimum Design Loads for Buildings and Other Structures
- Z. UL - Fire Resistance Directory.
- AA. FM Approvals - Roof Coverings and/or RoofNav assembly database.
- BB. FBC - Florida Building Code.
- CC. Miami-Dade Building Code Compliance - N.O.A. (Notice of Acceptance).
- DD. California Title 24 Energy Efficient Standards.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Perform work in accordance with all federal, state and local codes.
- B. Design Requirements:
 - 1. Uniform Wind Uplift Load Capacity
 - a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
 - 1) Design Code: ASCE 7, Method 2 for Components and Cladding.
 - 2) Importance Category:
 - a) IV
 - 3) Wind Speed: 118 mph
 - 4) Exposure Category:
 - a) C.
 - 5) Design Roof Height: 30 feet.

- 6) Roof Pitch: .25 :12.
- 7) Roof Area Design Uplift Pressure:
 - a) Zone 1 - Field of roof 40.2 psf
 - b) Zone 2 - Eaves, ridges, hips and rakes 50.9 psf
 - c) Zone 3 - Corners 67 psf
- 2. Live Load: 20 psf, or not to exceed original building design.
- 3. Dead Load:
 - a. Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.
- C. Energy Star: Roof System shall comply with the initial and aged reflectivity required by the U.S. Federal Government's Energy Star program.
- D. LEED: Roof system shall meet the reflectivity and emissivity criteria to qualify for one point under the LEED credit category, Credit 7.2, Landscape & Exterior Design to Reduce Heat Island - Roof.
- E. Roof System membranes containing recycled or bio-based materials shall be third party certified through UL Environment.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions.
- C. Shop Drawings: Submit shop drawings including installation details of roofing, flashing, fastening, insulation and vapor barrier, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.
- D. Design Pressure Calculations: Submit design pressure calculations for the roof area in accordance with ASCE 7 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins.
- E. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
 - 1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
 - 2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
 - 3. Product reflectivity and emissivity criteria to qualify for one point under the LEED credit category, Credit 7.2, Landscape & Exterior Design to Reduce Heat Island - Roof.
- F. Recycled or Bio-Based Materials: Provide third party certification through UL Environment of roof System membranes containing recycled or bio based materials.
- G. Verification Samples: For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- H. Manufacturer's Certificates: Provide to certify products meet or exceed specified requirements.

- I. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147. Testing must be performed at 77 deg. F. Tests at 0 deg. F will not be considered.
- J. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.
- K. Manufacturer's Fire Compliance Certificate: Certify that the roof system furnished is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.
- L. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last five years.
- C. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.
- D. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.
- E. Manufacturer Qualifications: Roofing system manufacturer shall have a minimum of 10 years' experience in manufacturing metal roofing products in the United States and be ISO 9001 certified. Maintains a "Certified" installer training program and a list of installing contractors. Has a designated Project Manager available to inspect the installation throughout the installation process at minimum of three times per week, and at completion. The Manufacturer shall submit a written report of each inspection to the owner. The Manufacturer has the primary responsibility for the system, following the minimum specified requirements. Upon completion, of each inspection, a digital report will be generated and provided for the architect and owner.
- F. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
- G. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section.
- B. Review installation procedures and coordination required with related Work.

- C. Inspect and make notes of job conditions prior to installation:
 - 1. Record minutes of the conference and provide copies to all parties present.
 - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
 - 3. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.
- B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.
- C. Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface except store KEE-Stone FB 60 rolls flat on a clean flat surface. No wet or damaged materials will be used in the application.
- D. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.
- E. Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.
- F. Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

1.9 COORDINATION

- A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.10 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

- A. Upon completion of the work, provide the Manufacturer's written and signed NDL Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition.
 - 1. Warranty Period:
 - a. 30 years from date of acceptance.
- B. Upon completion of the work, provide the Manufacturer's written and signed Edge-To-Edge NDL System Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installer, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition including Garland Metal

Components.

1. Warranty Period:
 - a. 30 years from date of acceptance.

- C. Installer is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work.
 1. Warranty Period:
 - a. 3 years from date of acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Garland Company, Inc. (The); 3800 E. 91st St., Cleveland, OH 44105. ASD. Toll Free: 800-321-9336. Phone: 216-641-7500. Fax: 216-641-0633. Web Site: www.garlandco.com.

- B. The City of St. Charles School District is utilizing the Omnia Partners Government Purchasing Alliance program for Roofing Supplies and Related Products and Services, as priced by and awarded to Garland/DBS, Inc., resulting from the competitively solicited Sealed Bid # PW1925 issued by the Racine County. The roofing installer is responsible for supplying the right quantity of these roofing materials to complete the **(The George M. Null Elementary School New Addition)** as detailed in this specification and is responsible for obtaining any additional materials that are required to properly install the specified roofing systems at no additional charge to the Owner. All materials needed to complete this project that are not listed on the OMNIA Partners Government Purchasing List of Materials attachment provided in this specification, but that are required in this specification, must be supplied by the roofing installer and meet stated performance specification listed in this document.

- C. Quantities to be purchased by the district. The roofing installer is responsible for supplying the right quantity of these roofing materials and is responsible for obtaining any additional materials that are required to properly install the specified roofing systems at no additional charge to the Owner. Upon request, a price list will be distributed to qualified bidding contractors who estimate they will need additional materials. Please contact Brent Boehringer at bboehringer@garlandind.com for additional pricing.

Product #	Product Name	Unit / Size	Coverage Rate	Quantity
7350-CR	KEE-Lock Foam	4/Box	600sq ft / case	4
7304-3	KEE-Lock WB Flashing Adhesive	PKG: 3.5 GL Pail	1-1.5gal./100 sq. ft.	4
9500	KEE Stone FB 60	8'x100' Roll	800 sq. Ft.	3
9501-NF	KEE Stone NF Flashing	4"x50' Roll	200 sq. ft	2
9504	KEE Stone Utility Roll	6"x50' Roll	25 sq. ft.	2
29360	KEE Sealant	24 Tubes per Case		1 Case
29320	KEE Inside Corners			10EA
29325	KEE Outside Corners			40 EA
34321	KEE Split Pipe Boot 3"-5"			3 EA
34331	KEE Split Pipe Boot 6"-9"			3 EA

29300	KEE T-Joint Covers	100/Carton	24"x100'	1 Carton
29330	KEE Walkway Roll	30"x60'		1
4113	HPR Torch Base	34'8" x 3'3"	100 sq. ft.	25

2.2 COLD APPLIED 2-PLY THERMOPLASTIC HYBRID ROOF SYSTEM - KEE-Stone FB 60

- A. Nailable Base Sheet: One ply fastened to the deck per wind uplift calculations.
 - 1. VersiPly 40:
- B. Base (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive:
 - 1. HPR Torch Base:
- C. Thermoplastic Cap (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive (2):
 - 1. KEE-Stone FB 60:
- D. Interply Adhesive: (2)
 - 1. KEE-Lock Foam
- E. Flashing Base Ply: One ply bonded to the prepared substrate with Flashing Ply Adhesive:
 - 1. StressBase 120:
- F. Flashing Cap (Ply) Sheet: One ply bonded to the prepared substrate with Flashing Ply Adhesive:
 - 1. KEE-Stone FB 60 Flashing.
- G. Flashing Ply Adhesive (1):
 - 1. Green-Lock Plus Flashing Adhesive.
- H. Flashing Ply Adhesive (2):
 - 1. KEE-Lock Foam

2.3 ACCESSORIES:

- A. Roof Insulation: In accordance with Section 07220.
- B. Roof Insulation: Provide G-P Gypsum DenDeck Prime, G-P Gypsum DenDeck DuraGuard, USG Securrock for proper adhesion of the self-adhered base sheet in accordance with Section 07220.
- C. Walkway Pads - Commercial Innovations Walkway Pads: As recommended and furnished by the membrane manufacturer set in approved adhesive to control foot traffic on roof top surface and provide a durable system compliant non-slip walkway.
- D. Urethane Sealant Hybrid - Tuff-Stuff MS: One part, non-sag sealant as approved and furnished by the membrane manufacturer for moving joints.
 - 1. Tensile Strength, ASTM D 412: 250 psi
 - 2. Elongation, ASTM D 412: 450%
 - 3. Hardness, Shore A ASTM C 920: 35
 - 4. Adhesion-in-Peel, ASTM C 92: 30 pli
- E. Non-Shrink Grout GarRock: All weather fast setting chemical action concrete material to fill pitch pans.

1. Flexural Strength, ASTM C 78: (modified) 7 days 1100psi
 2. High Strength, ASTM C 109: (modified) 24 days 8400lbs (3810kg)
- F. Pitch Pocket Sealer - Seal-Tite: Two part, 100% solids, self-leveling, polyurethane sealant for filling pitch pans as recommended and furnished by the membrane manufacturer.
1. Durometer, ASTM D 2240: 40-50 Shore
 2. Elongation, ASTM D 412: 250%
 3. Tensile Strength, ASTM D 412: 200 @ 100 mil
- G. Glass Fiber Cant - Glass Cant: Continuous triangular cross Section made of inorganic fibrous glass used as a cant strip as recommended and furnished by the membrane manufacturer.

2.4 EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

- A. Pre-Manufactured Edge Metal: R-Mer Force Flash-less Snap-On Fascia Cover and Splice Plate.
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 24 gauge, 22 gauge or 20 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality
 2. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .032" nom. or .040" nom. or .050" nom. or .063" nom.
- B. Pre-Manufactured Edge Metal: R-Mer Edge Snap-On Fascia Cover and Splice Plate.
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 24 gauge, 22 gauge or 20 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.
 2. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .032" nom. or .040" nom. or .050" nom. or .063" nom.
- C. Pre-Manufactured Edge Metal: R-Mer Edge Extruded Fascia Cover and Splice Plate.
1. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .063" min.
- D. Pre-Manufactured Coping Cap: R-Mer Edge Coping Cap Cover and Splice Plate.
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 24 gauge, 22 gauge or 20 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.
 2. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .040" nom. or .050" nom. or .063" nom
- E. Pre-Manufactured Edge Metal: R-Mer Force Flash-less Snap-On Fascia Extruded Base Anchor and Components.
1. Base Anchor: 6005A-T61 extruded aluminum.
 2. Compression Seal for top of anchor: TPE thermoplastic elastomer.
 3. Sealant for Flange: Green-Lock Sealant XL: Single-component high performance 100% solids, interior and exterior polyether joint sealant.
- F. Pre-Manufactured Edge Metal: R-Mer Edge Snap-On Fascia or Extruded Fascia Continuous Cant
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 0.0299 nom./22 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.
- G. Pre-Manufactured Coping Cap: R-Mer Edge Coping Chairs
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 0.0635 nom./16 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.
- H. Pre-Manufactured Edge Metal Finishes:

1. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, as shipped from the mill
 2. Exposed surfaces for coated panels:
 - a. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.
Weathering finish as referred by National Coil Coaters Association (NCCA). Provided with the following properties.
 - 1) Pencil Hardness: ASTM D3363, HB-H / NCCA II-2.
 - 2) Bend: ASTM D-4145, O-T / NCCA II-19
 - 3) Cross-Hatch Adhesion: ASTM D3359, no loss of adhesion
 - 4) Gloss (60 deg. angle): ASTM D523, 25+/-5%
 - 5) Reverse Bend: ASTM D2794, no cracking or loss of adhesion
 - 6) Nominal Thickness: ASTM D1005
 - a) Primer: 0.2 mils
 - b) Topcoat, 0.7 mils min
 - c) Clear Coat (optional, only used with 22 ga. steel) 0.3 mils
 - 7) Color: Provide as specified. (Subject to minimum quantities)
- I. Manufactured Flashing Ply: R-MER Ply galvalume steel and modified membrane roof termination/flashing system comprised of a flexible, tie-in membrane, factory-bonded within a watertight, mechanical seal to a galvalume steel vertical flashing or fascia reveal profile. Siliconized modified polyester, epoxy primer baked both sides. Modified membrane is a 180 mil, Styrene-Butadiene-Styrene SBS (Styrene-Butadiene-Styrene) rubber modified membrane reinforced with a dual fiberglass scrim.
1. Tensile Strength, ASTM D 5, 147
 - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 210 lbf/in CMD 210 lbf/in
 - b. 50 mm/min. @ 23 +/- 3 deg. C MD 36.75 kN/m CMD 36.75 kN/m
 2. Tear Strength, ASTM D 5147
 - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 250 lbf CMD 250 lbf
 - b. 50 mm/min. @ 23 +/- 3 deg. C MD 1112 N CMD 1112 N
 3. Elongation at Maximum Tensile, ASTM D5147
 - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6.0% CMD 6.0%
 - b. 50 mm/min. @ 23 +/- 3 deg. C MD 6.0% CMD 6.0%
 4. Low Temperature Flexibility, ASTM D5147: Passes -30 deg. F (-34 deg. C)
 5. Coating Properties:
 - a. Pencil Hardness, NCCA II-2 - ASTM D3363, F-H
 - b. Bend, NCCA II-19, ASTM D 4145, 2-T
 - c. Adhesion / Cross-Hatch, ASTM D3359, no loss of adhesion
 - d. Gloss (60 deg. angle), ASTM D 523, 90 +/- 5%
 - e. Reverse Impact, ASTM D 2794 no cracking or loss of adhesion
 - f. Nominal Thickness, ASTM D 1005, primer and topcoat 1.0 mils.
- J. Flashing Boot - Rubbertite Flashing Boot: Neoprene pipe boot for sealing single or multiple pipe penetrations adhered in approved adhesives as recommended and furnished by the membrane manufacturer.
- K. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.
- L. Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be welded/soldered watertight. See details for design.
- M. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled.

- N. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.
- O. Liquid Flashing - Tuff-Flash: An asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings.
 - 1. Tensile Strength, ASTM D 412: 400 psi
 - 2. Elongation, ASTM D 412: 300%
 - 3. Density @77 deg. F 8.5 lb/gal typical
- P. Fabricated Flashings: Fabricated flashings and trim are specified in Section 07620.
 - 1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the CDA Copper Development Association "Copper in Architecture - Handbook" as applicable.
- Q. Manufactured Roof Specialties: Shop fabricated copings, fascia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim are specified in Section 07710.
 - 1. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.
- C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.
- D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. General: Clean surfaces thoroughly prior to installation.
 - 1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - 2. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
 - 3. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
 - 4. Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
 - 5. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
 - 6. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
 - 7. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.

3.3 INSTALLATION - GENERAL

- A. Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.
- B. General: Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
 - 1. Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
 - 2. Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.
- C. Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water
- D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the upper edge of the membrane when strapping the plies.

3.4 INSTALLATION COLD APPLIED ROOF SYSTEM

- A. Base Ply: Cut base ply sheets into 18 foot lengths and allow plies to relax before installing. Install base sheet in Interply Adhesive: applied at the rate required by the manufacturer. Shingle base sheets uniformly to achieve one ply throughout over the prepared substrate. Shingle in proper direction to shed water on each large area of roofing.
 - 1. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
 - 2. Solidly bond to the substrate and adjacent ply with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
 - 3. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Use care to eliminate air entrapment under the membrane.
 - 4. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
 - 5. Extend plies 2 inches beyond top edges of cants at wall and projection bases.
 - 6. Install base flashing ply to all perimeter and projection details.
 - 7. Allow the one ply of base sheet to cure at least 30 minutes before installing the modified membrane. However, the modified membrane must be installed the same day as the base plies.
- B. Thermoplastic Cap Ply: Allow plies to relax before installing. Install in interply adhesive applied at the rate required by the manufacturer. Shingle sheets uniformly over the prepared substrate to achieve the number of plies specified. Shingle in proper direction to shed water on each large area of roofing.
 - 1. All field seams exceeding 10 feet in length shall be welded with an approved automatic

- welder.
2. All field seams must be clean and dry prior to initiating any field welding. Remove foreign materials from the seams (dirt, oils, etc.) with acetone or authorized alternative. Use CLEAN WHITE COTTON cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. Do not use denim or synthetic rags for cleaning.
 3. Contaminated areas within a membrane seam will inhibit proper welding and will require a membrane patch or strip.
 4. All welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld. The lap or seam area of the membrane may be intermittently tack welded to hold the membrane in place.
 5. The back interior edge of the membrane shall be welded first, with a thin, continuous weld to concentrate heat along the exterior edge of the lap during the final welding pass.
 6. Follow local code requirements for electric supply, grounding and surge protection. The use of a dedicated, portable generator is highly recommended to ensure a consistent electrical supply, without fluctuations that can interfere with weld consistency.
 7. Properly welded seams shall utilize a 1.5 inch wide nozzle, to create a homogeneous weld, a minimum of 1.5 inches in width.
- C. Fibrous Cant Strips: Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.
- D. Wood Blocking, Nailers and Cant Strips: Provide wood blocking, nailers and cant strips as specified in Section 06114.
1. Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
 2. Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
 3. Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
 4. Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.
- E. Metal Work: Provide metal flashings, counter flashings, parapet coping caps and thru-wall flashings as specified in Section 07620 or Section 07710. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.
- F. Termination Bar: Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.
- G. Flashing Base Ply: Install flashing sheets by the same application method used for the base ply.
1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
 2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
 3. Adhere to the underlying base ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
 4. Solidly adhere the entire flashing ply to the substrate. Secure the tops of all flashings that

are not run up and over curb through termination bar fastened at 6 inches (152 mm) O.C. and sealed at top.

5. Seal all vertical laps of flashing ply with a three-course application of trowel-grade mastic and fiberglass mesh.
6. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
7. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work.
8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

H. Flashing Cap Ply:

1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
3. Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
4. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
5. Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
6. All stripping shall be installed prior to flashing cap sheet installation.
7. Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

I. Roof Walkways: Provide walkways in areas indicated on the Drawings.

3.5 INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

- A. Fabricated Flashings: Fabricated flashings and trim are provided as specified in Section 07620.
1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the Copper Development Association "Copper in Architecture - Handbook" as applicable.
- B. Manufactured Roof Specialties: Manufactured copings, facia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim are provided as specified in Section
1. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the National Roofing Contractor's Association "Roofing and Waterproofing Manual" as applicable.
- C. Scupper Through Wall:
1. Inspect the nailer to assure proper attachment and configuration.
 2. Run base ply over nailer, into scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
 3. Install a scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed

and soldered. Prime scupper and allow to dry.

4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
5. Strip in flange of scupper box with base flashing ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.
6. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
7. Install a second ply of thermoplastic flashing cap ply heat welded over the thermoplastic cap ply, 9 inches (228 mm) on to the field of the roof.
8. Heat weld a cover strip over all seams.

D. Scupper Through Wall (Overflow):

1. Inspect the nailer to assure proper attachment and configuration.
2. Run base ply over nailer up the overflow, into the scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
3. Install scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed and soldered. Prime scupper and allow to dry.
4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
5. Strip in flange scupper box with base flashing ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.
6. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
7. Install a second ply of thermoplastic flashing cap ply heat welded over the thermoplastic cap ply, 9 inches (228 mm) on to the field of the roof.
8. Heat weld a cover strip over all seams.

E. Coping Cap:

1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm). Prime vertical wall and allow to dry.
2. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering entire wall and wrapped over top of wall and down face with 6 inches (152 mm) on to the base field ply and set in bitumen. Nail base flashing ply at 8 inches (203 mm) o.c. on the back side of the parapet wall.
4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
5. Install a second ply of thermoplastic flashing cap ply heat welded over the thermoplastic cap field ply, 9 inches (228 mm) on to the field of the roof.
6. Heat weld a cover strip over all seams.
7. Install continuous cleat and fasten at 6 inches (152 mm) o.c. to outside wall.
8. Install new metal coping cap hooked to continuous cleat.
9. Fasten inside cap 24 inches (609 mm) o.c. with approved fasteners and neoprene washers through slotted holes, which allow for expansion and contraction.

F. Pre-manufactured Snap-On Coping Cap:

1. Install miters first.
2. Position base flashing ply over the wall edge covering nailers completely, fastening 8 inches on center. Install base ply and thermoplastic cap ply with proper material and procedure according to manufacturer's recommendations.
3. Install minimum 16 gauge, 16 inch long by specified width anchor chair at [Contact Garland Representative] feet on center.
4. Install 6 inch wide splice plate by centering over 16 inch long by specified width anchor chair. Apply two beads of sealant to either side of the splice plate's center. Approximately 2 inches from the coping cap joint. Install Coping Cap by hooking outside hem of coping on outside face of anchor chair. Press downward on inside edge of coping

until "snap" occurs and hem is engaged on the entire chair.

- G. Surface Mounted Counterflashing/Coping Cap:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Prime vertical wall and allow to dry.
 2. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
 3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to the base field ply and set in bitumen.
 4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
 5. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
 6. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall. Alternatively use caulk to replace the butyl tape.
 7. Secure counterflashing set on butyl tape above flashing. Fasten 8 inches (203 mm) o.c. and caulk top of counterflashing.
 8. Attach tapered board to top of wall (minimum slope 1/4 -12). Do not use organic fiberboard or perlite.
 9. Cover tapered board and all exposed wood with base flashing ply. Fasten inside and out at 8 inches (203 mm) o.c.
 10. Install continuous cleat and fasten at 6 inches (152 mm) o.c. to outside wall.
 11. Install new metal coping cap hooked to continuous cleat.
 12. Fasten inside of cap 24 inch (609 mm) o.c. with approved fasteners and neoprene washers.
- H. Base Flashing For Non-Supported Deck:
1. Inspect the nailer to assure proper attachment and configuration. The wood cant strip should be mechanically attached to the vertical and horizontal wood nailers.
 2. Install compressible insulation in neoprene cradle between wall and vertical wood nailer.
 3. Prime vertical wall and allow to dry.
 4. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
 5. Install base flashing ply covering entire wall and wrapped to top of wood nailer with 6 inches (152 mm) on to base field ply. Nail membrane at 8 inches (203 mm) o.c. at the top of the wood nailer.
 6. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
 7. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof and run over the top of the wood nailer and secured 8 inches (203 mm) o.c..
 8. Attach counterflashing through wall flashing at a spacing of 24 inches (609 mm) o.c.
- I. Expansion Joint:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Chamfer top of curb. Prime vertical curb and allow to dry.
 2. Mechanically attach wood cant to expansion joint nailers. Run all base field plies over cant a minimum of 2 inches (50 mm).
 3. Install compressible insulation in neoprene cradle.
 4. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
 5. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
 6. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
 7. Install pre-manufactured expansion joint cover. Fasten sides at 12 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between

metal covers.

J. Equipment Support:

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical and allow to dry.
2. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering the curb set in bitumen with 6 inches (152 mm) on to the base field ply and set in bitumen.
4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
5. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
6. Install pre-manufactured cover. Fasten sides at 24 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.
7. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

K. Curb Detail/Air Handling Station:

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical and allow to dry.
2. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering the curb set in bitumen with 6 inches (152 mm) on to the base field ply and set in bitumen.
4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
5. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
6. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
7. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

L. Exhaust Fan:

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical and allow to dry.
2. Set cant in bitumen. Run all base field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to the base field ply and set in bitumen.
4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
5. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
6. Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendation.

M. Roof Drain:

1. Plug drain to prevent debris from entering plumbing.
2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
3. Run roof system base plies over drain. Cut out plies inside drain bowl.
4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper and allow to dry.
5. Install base flashing ply (40 inch square minimum) in bitumen.
6. Install thermoplastic cap ply (48 inch square minimum) in bitumen or foam adhesive.
7. Install clamping ring and assure that all plies are under the clamping ring.
8. Remove drain plug and install strainer.

- N. Plumbing Stack:
1. Minimum stack height is 12 inches (609 mm).
 2. Run roof base ply over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
 3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
 4. Install base flashing ply in bitumen.
 5. Install thermoplastic cap ply in bitumen or foam adhesive.
 6. Caulk the intersection of the membrane with elastomeric sealant.
 7. Turn sleeve a minimum of 1 inch (25 mm) down inside of stack.
- O. Pitch Pocket Umbrella:
1. Run all base plies up to the penetration.
 2. Place the pitch pocket over the penetration and prime all flanges.
 3. Strip in flange of pitch pocket with one ply of base flashing ply. Extend 6 inches (152 mm) onto field of roof.
 4. Then install thermoplastic cap field ply run over the base flashing ply in bitumen or foam adhesive.
 5. Install the thermoplastic flashing ply in bitumen or foam over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
 6. Fill pitch pocket half full with non-shrink grout. Let this cure and top off with pourable sealant.
 7. Caulk joint between roof system and pitch pocket with elastomeric sealant.
 8. Place a watershedding type bonnet over the top of the pitch pocket and clamp the top with a drawband collar. Caulk the upper edge of the band with an elastomeric sealant.

3.6 CLEANING

- A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- B. Remove asphalt markings from finished surfaces.
- C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.7 PROTECTION

- A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
- B. Protect exposed surfaces of finished walls with tarps to prevent damage.
- C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.
- D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.
- E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.8 FIELD QUALITY CONTROL

- A. Inspection: Provide manufacturer's field observations at start-up and at intervals of approximately 30 percent, 60 percent and 90 percent completion. Provide a final inspection upon completion of

the Work.

1. Warranty shall be issued upon manufacturer's acceptance of the installation.
2. Field observations shall be performed by a Sales Representative employed full-time by the manufacturer and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.
3. Provide observation reports from the Sales Representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
4. Provide a final report from the Sales Representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

3.9 SCHEDULES

A. Base (Ply) Sheet:

1. HPR Torch Base: 110 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim. Designed for torch applications with a burn-off backer that indicates when the material is hot enough to be installed.
 - a. Tensile Strength, ASTM D 5147
 - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 210 lbf/in XD 210 lbf/in
 - 2) 50 mm/min. @ 23 +/- 2 deg. C MD 36.75 kN/m XD 36.75 kN/m
 - b. Tear Strength, ASTM D 5147
 - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 300 lbf XD 300 lbf
 - 2) 50 mm/min. @ 23 +/- 2 deg. C MD 1,334 N XD 1,334 N
 - c. Elongation at Maximum Tensile, ASTM D 5147
 - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6% XD 6%
 - 2) 50 mm/min. @ 23 +/- 2 deg. C MD 6% XD 6%
 - d. Low Temperature Flexibility, ASTM D5147, Passes -30 deg. F (-34.4 deg. C)

B. Thermoplastic/Modified Cap (Ply) Sheet:

1. KEE-Stone FB 60: 60 mil thermoplastic, ketone ethylene ester (KEE) roofing membrane with polyester scrim. ASTM D6754
 - a. Breaking Strength, ASTM D 751, Proc. B, strip
 - 1) 375 lbf. (1,668 N)
 - b. Tear Strength ASTM D 751
 - 1) 120 lbf. min. (534 N)
 - c. Elongation at Break (%), ASTM D 751, Proc. B, Strip
 - 1) 40.0%

C. Interply Adhesive:

1. KEE-Lock Foam: Dual component, single bead (ribbon applied) urethane insulation/membrane adhesive.
 - a. Tensile Strength (ASTM D 412) 250 psi
 - b. Density (ASTM D 1875) 8.5 lbs./gal.
 - c. Viscosity (ASTM D 2556) 22,000 - 60,000 cP
 - d. Peel Strength (ASTM D 903) 17 lb./in.
 - e. Flexibility (ASTM D 816) Pass @ -70 deg. F (-56.7 deg. C)

D. Flashing Base Ply:

1. StressBase 120: 120 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet with dual fiberglass reinforced scrim, performance requirements according to ASTM D 5147.
 - a. Tensile Strength, ASTM D 5147
 - 1) 2 in/min. @ 0 +/- 3.6 deg. F MD 100 lbf/in XD 100 lbf/in
 - 2) 50mm/min. @ -17.78 +/- 2 deg. C MD 17.5 kN/m XD 17.5 kN/m

- b. Tear Strength, ASTM D 5147
 - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 100 lbf XD 85 lbf
 - 2) 50mm/min. @ 23 +/- 2 deg. C MD 444 N XD 378 N
 - c. Elongation at Maximum Tensile, ASTM D 5147
 - 1) 2 in/min. @ 0 +/- 3.6 deg. F MD 4 % XD 4 %
 - 2) 50 mm/min. @ -17.78 +/- 2 deg. C MD 4 % XD 4 %
 - d. Low Temperature Flexibility, ASTM D 5147
 - 1) Passes -40 deg. F (-40 deg. C)
- E. Flashing Ply Adhesive:
- 1. KEE-Lock Foam: Dual component, single bead (ribbon applied) urethane insulation/membrane adhesive.
 - a. Tensile Strength (ASTM D 412) 250 psi
 - b. Density (ASTM D 1875) 8.5 lbs./gal.
 - c. Viscosity (ASTM D 2556) 22,000 - 60,000 cP
 - d. Peel Strength (ASTM D 903) 17 lb./in.
 - e. Flexibility (ASTM D 816) Pass @ -70 deg. F (-56.7 deg. C)
 - 2. Green-Lock Plus Flashing Adhesive: Cold applied solvent free flashing adhesive: zero V.O.C.
 - a. Non-Volatile Content ASTM D 4586 100%
 - b. Density ASTM D 1475 11.8 lbs./gal. (1.17 g/cm³)
 - c. Viscosity Brookfield 400,000 cPs.
 - d. Flash Point ASTM D 93 400 deg. F min. (232 deg. C)
- F. Surfacing:
- 1. Flashing Cap (Ply) Sheet:
 - a. KEE-Stone FB 60 Flashing: 60 mil thermoplastic, ketone ethylene ester (KEE) roofing membrane with polyester scrim. ASTM D 6754.
 - 1) Breaking Strength, ASTM D 751, Proc. B, strip
 - a) 378 lbf
 - 2) Tear Strength ASTM D 751
 - a) 120 lbf. minimum.
 - 3) Elongation at Break (%), ASTM D 751, Proc. B, Strip
 - a) 40.0%

END OF SECTION 07550

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof penetration sleeves and bonnets.
 - 2. Receivers.
 - 3. Counter flashings.
 - 4. Sanitary vent pipes.
 - 5. Curb cap flashings.
 - 6. Exhaust vents.
 - 7. Copings.
 - 8. Dip edge.
 - 9. Gutters and downspouts.
 - 10. Miscellaneous sheet metal accessories.
- B. Related Sections include the following:
 - 1. Section 06105 "Miscellaneous Carpentry"
 - 2. Section 07221 "Roof Board Insulation".
 - 3. Section 07550 "Modified Bituminous Membrane Roofing".

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Federal Specifications (FS).
- C. National Roofing Contractor's Association (NRCA): NRCA Roofing and Waterproofing Manual, latest edition.
- D. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA): Architectural Sheet Metal Manual, latest edition.
- E. ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.4 WARRANTY

- A. Contractor's Warranty: Provide Owner a written warranty which shall warrant sheet metal work to be free of leaks and defects in materials and workmanship for two years after date of final acceptance by owner.
- B. For pre-finished metal, provide manufacturer's twenty-year guarantee covering deterioration or failure of the fluoropolymer finish.

1.5 PERFORMANCE REQUIREMENTS

- A. Fabricate and install sheet metal edge flashings to comply with ANSI/SPRI ES-1 requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable pre-finished Sheet Metal Manufacturer's:
 - 1. The Garland Company, Inc.

2.2 SHEET METAL MATERIAL

- A. Pre-finished Metal: "Kynar 500" or "Hylar 5000" fluoropolymer pre-finished G90 galvanized/galvalume sheet metal, minimum 24 gauge. "Kynar 500" or "Hylar 5000" finish shall consist of a two-coat Polyvinylidene fluoride, minimum 70 percent by weight in coatings, dry film thickness 1 mil, factory applied by metal manufacturer or supplier. Color to be selected by Owner and Architect from manufacturer's standard color chart.
- B. Zinc-coated (Galvanized) Sheet Metal: Commercial Quality with 0.20 percent copper, in accordance with ASTM A 526 except ASTM A 527 for lock forming; coating designation G() hot-dip galvanized, and mill phosphatized for painting in accordance with ASTM A 525 (paint-grip type), 22 gauge minimum.
- C. Sheet Lead: FS QQ-L-201, Grade B; 2-1/2 pounds per square foot, 0.0391-inches thick minimum used for sanitary vent flashing.
- D. Stainless Steel Sheet Metal: ASTM A240, Type 304, ASTM A480, No. 2B/2D Mill Finish, gauge as scheduled.

2.3 FASTENERS

- A. Fasteners shall be same metal as flashing and sheet metal being joined.
- B. Exposed fasteners shall be self-sealing or gasketed for weathertight installation.
- C. Heads of fasteners, including but not limited to, rivets, screws, and bolts, that are exposed or visible shall have same manufactured finishes as item being secured; color to match when applicable.
- D. Mechanical Fasteners:
 - 1. Washers: Steel washers with bonded rubber sealing gasket.
 - 2. Screws: Self-tapping sheet metal type compatible with material fastened.
 - 3. Rivets: Stainless steel material for the stem with closed end, head of color to match sheet metal items being joined.

2.4 RELATED MATERIALS

- A. Solder:
 - 1. ASTM B 32, alloy grade 58, 50 percent tin, 50 percent lead.
 - 2. For use with stainless steel: 60-40 tin/lead solder, ASTM B 32.
- B. Flux:
 - 1. Phosphoric acid type, manufacturer's standard.
 - 2. For use with steel or copper: Rosin flux.
 - 3. For use with stainless steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.
- C. Underlayment: Elastomeric self-adhering sheeting suitable for high-temperature; minimum 30 mil thickness: "WIP 300HT" by Carlisle or pre-approved equal.
- D. Adhesives: Type recommended by flashing sheet manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet.

- E. Metal Accessories: Sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.
- F. Sealant: As recommended by the manufacturer.
- G. Termination Bar: 1/8-inch thick, 1-inch wide extruded aluminum bar with flat profile, factory punched holes spaced 6-inches on center.

2.5 FABRICATION, GENERAL

- A. Fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and approved shop drawings.
- B. Comply with material manufacturer's instructions and recommendations for forming material.
- C. Shop fabricate work to the greatest extent possible.
- D. Fabricate for waterproof and weather resistant performance with expansion provisions for running work sufficient to permanently prevent leakage, damage, or deterioration of work. Form work to fit substrates.
- E. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling.
- F. Form materials with straight lines, sharp angles, smooth curves and true levels. Avoid tool marks, buckling, and oil canning.
- G. Fold back edges of exposed ends of sheet metal edge to form hem, 1/2-inch minimum.
- H. Lap joints 1-inch minimum. Rivet and solder joints on parts that are to be permanently and rigidly assembled for stainless steel sheet metal. Install rivets, spaced 1-inch on center and apply solder to secure and seal exposed edge of sheet metal in a uniform continuous bead with smooth top finish. Clean residue upon completion of soldering process. Fabricate sheet metal assemblies so that adjoining sections are nested to achieve continuous metal-to-metal contact.
- I. Seams:
 - 1. Fabricate non-moving seams in sheet metal with flat-lock seams.
 - 2. Pre-finished Galvanized Sheet Metal: Seal pre-finished metal seams with rivets, spaced 1-inch on center, and sealant.

2.6 FABRICATED ITEMS

- A. Receivers and Counter Flashings: Minimum 24-gauge prefinished or stainless steel sheet metal formed in maximum 10-foot lengths.
- B. Wind Clips: Minimum 24 gauge stainless steel or pre-finished sheet metal, 1-inch wide, length to engage counter flashing a minimum of 1/2-inch.
- C. Roof Penetration Flashing Pan and Bonnet: Minimum 24 gauge stainless steel sheet metal. Fabricate pan with 1/4-inch hem at top edge, 4-inch wide horizontal flanges; to provide installed minimum clear inside perimeter dimension of 2-inches and 6-inch height. Fabricate bonnet in two-piece adjustable construction with 1/2-inch caulk through along top edge and a skirt, with hemmed edge; length to extend over top edge of pan a minimum of 2-inches.
- D. Cleats/Clips: Continuous strips, 22 gauge sheet metal, same metal type and profile as adjacent metal trim.
- E. Sanitary/Plumbing vent Pipe: 2-1/2 pound lead pre-formed flashing sleeve with 4-inch flanges and of proper size/height to fold down inside of vent pipe a minimum of 1-inch.

- F. Pipe Box (Base, Hood and Face Plate): 24 gauge stainless steel sheet metal. Base shall be 8-inches in height with 4-inch wide horizontal flanges. Size to provide minimum 2-inch clearance between box and pipes.
- G. Heat Exhaust/Gravity Vent/Turbine Vent: 24 gauge stainless steel sheet metal. Base shall be 8-inches in height with 4-inch wide horizontal flanges. Hood to conceal top of base.
- H. Coping: 24 gauge pre-finished sheet metal with 6-inch wide cover plates of same material/profile.
- I. Drip Edge: 24 gauge pre-finished sheet metal with 6-inch wide cover plates of same material/profile.
- J. Gutters: 24 gauge pre-finished sheet metal with straps of the same material/profile.
- K. Downspouts: 24 gauge pre-finished sheet metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are smooth and clean to extent needed for sheet metal work.
- B. Verify that reglets, nails, cants, and blocking to receive sheet metal are installed and free of debris.
- C. Do not start sheet metal work until conditions are satisfactory.

3.2 INSTALLATION

- A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Install prefabricated corners or transitions at changes in direction, elevation or plane, and at intersections. Locate field joints not less than 12-inches, not more than 3 feet from actual corner. Laps for all metals, except for prefinished metal, shall be 1-inch wide, fastened with rivets spaced 1-inch on-center and soldered.
- B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners where possible; and set units true to line and level as indicated. Install work with laps, joints, and seams permanently watertight and weatherproof.
- C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.
- D. Prime all flanged sheet metal and allow to dry completely. Set in a liberal bed of SBS modified mastic and strip in to achieve a full finished two plies of SBS modified roofing membrane.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating affected surfaces with zinc chromate or other permanent liquid-applied or sheet product separation at locations of contact.
- F. Continuous Cleat: At exposed edges of metal edge flashings, fascias, copings, and where required, attach continuous cleat at 6-inches on-center with appropriate fasteners metal or steel substrate. At a distance of 10 feet from each direction of corner, install fasteners spaced 3-inches on-center. Install cleat so fascia extends a minimum of 1-inch below top of exterior wall finish.
- G. Counter flashings:
 - 1. Install counter flashings under equipment housing flanges and receivers along rise or parapet walls to extend a minimum of 4-inches below top edge of base flashing.

2. Secure counter flashing at 6-inches on-center with self-tapping screws.
 3. Saw-cut reglet mounted assemblies: Saw cut new joint, 1/2-inch X 1-inch deep, in masonry/concrete where required and to install new receiver. Clean and prepare joint surfaces to receive sealant and insert receiver into joint. Secure new receiver in place with lead wedges spaced 12-inches on-center wedged into joint. Install backer rod into saw-cut reglet and apply a continuous bead of sealant along reglet and top edge of receiver and tool sealant to provide outward sloping finished surface. Secure counter flashing to receiver utilizing self-tapping grommetted screws spaced 6-inches on-center.
 4. Surface-mounted assemblies: Secure 2-piece surface-mounted receiver and counter flashing assemblies along substrates. Install sealant tape between receiver and substrate. Secure receiver to substrate with termination bar and appropriate fasteners spaced 12-inches o.c. Install a continuous bead of sealant along caulk trough/top edge of receiver and tool sealant to provide outward sloping finished surface. Secure counter flashing to receiver utilizing grommetted self-tapping screws spaced 6-inches on-center.
 5. Install receivers extending behind wall finish and secure vertical flange of receiver 6-inches on-center to back-up wall or metal wall panels. Extend underlayment and/or dampproofing material over vertical flange of receiver, where applicable.
 6. Lap adjacent sections of receivers and counter flashings a minimum of 4-inches. Apply a continuous bead of sealant in lap.
 7. Secure counter flashing to equipment flanges utilizing self-tapping screws spaced 6-inches on-center.
 8. Install wind clips to termination bar spaced 24-inches on-center and engage drip edge of counter flashing a minimum of 1/2-inch.
 9. Fabricate the counter flashing to form an integral closure at terminations.
- H. Penetration Pans:
1. Install compressible fill insulation between penetrating element and deck.
 2. Prime tops and bottoms of flanges of penetration pans.
 3. Pop rivet and fully solder joints in pan and flanges.
 4. Install penetration pan with flanges set in a uniform troweling of modified bitumen mastic on SBS membrane base ply, secure flange with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in flanges.
 5. Fill penetration pan to within 1-inch (25mm) of top of pan with non-shrink grout. Clean surfaces of pan and penetrating element and fill remainder of pan with pourable sealer.
 6. Install sheet metal bonnet or hood to conceal the top of the penetration pan.
- I. Roof Penetration Hoods and Bonnet:
1. Install sheet metal hood or bonnet on penetrating element to cover the top of the penetration pans.
 2. Round or Pipe Penetrations:
 - a. Set bonnet in sealant.
 - b. Install stainless steel draw-band and tighten to secure to penetration.
 - c. Seal top of bonnet with sealant.
 3. Square Penetration:
 - a. Secure bonnet to penetration with termination bar and self-drilling screws.
 - b. Set bonnet in sealant.
 - c. Seal top of bonnet with sealant.
 4. Angle or Structural Steel Penetration:
 - a. Attach bonnet to structural steel member by welding.
 - b. Paint assembly after installation.
- J. Pipe Box:
1. Pop rivet and fully solder joints and seams in sheet metal base and hood.
 2. Prime top and bottom of flanges of base.

3. Install penetration pan with flanges set in a uniform troweling of modified bitumen mastic on SBS membrane base ply, secure flange with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in flanges.
 4. Fill base with grout or spray foam to a height of 3/4 of the total pan height.
 5. Fill remaining height of base with pourable sealer.
 6. Install hood over base, securing to each side with self-tapping screws, and sloping down toward front of box.
 7. Install face plate to cover box opening around pipe penetrations and apply sealant around pipe configuration at face plate.
- K. Sanitary/Plumbing Vent Pipes:
1. Prime top and bottom flanges of lead flashing sleeve. Set flange or embed in uniform troweling of modified bitumen mastic on SBS membrane base ply. Prime top side of flange to receive strip-in membrane.
 2. Fold lead sleeve down inside pipe a minimum of 1-inch. Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve. Paint exposed lead flashing with elastomeric coating to match color of membrane top ply.
- L. Heat Exhaust/Gravity Vent/Turbine Vent/Goose-neck Vent:
1. Prime top and bottom of flanges of base.
 2. Install penetration pan with flanges set in a uniform troweling of modified bitumen mastic on SBS membrane base ply, secure flange with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in flanges.
 3. At heat exhaust vents, install sheet metal bonnet secured to vent pipe with stainless steel draw band and apply sealant along top edge of bonnet and tool sealant to provide outward sloping finished surface.

3.3 CLEANING

- A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean and free of stains, scrap, and debris.
- B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration/damage of finishes. Paint (color to match) areas of prefinished metal where finish is damaged. Replace sheet metal items when damaged finish can not be repaired to an acceptable condition.
- C. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

END OF SECTION 07620

SECTION 07720 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof hatches.
 - 2. Safety railings and gate for roof hatches.
 - 3. Ladder Safety Post

1.2 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated.
- B. Shop Drawings: For roof accessories.
- C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.
- D. Operation and maintenance data.
- E. Warranty: Sample of special warranty.

1.3 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
- B. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- C. Sealants: As recommended by roof accessory manufacturer for installation indicated.

2.3 ROOF HATCH

- A. Roof Hatches: This specification is based upon Type S Roof Hatch as manufactured by the Bilco Company. Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised to the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide equal products by one of the following:
 - a. Babcock-Davis, Inc..
 - b. J. L. Industries, Inc.
 - c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - d. Pate Company.
- B. Type and Size: Single-leaf lid, size as detailed.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Aluminum sheet, 11 guage thick.
 - 1. Finish: Mill Finish.
- E. Construction:
 - 1. Insulation: Manufacturer's standard.
 - 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
- F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 1. Provide two-point latch on lids larger than 84 inches.

2.4 SAFETY RAILING SYSTEM

- A. Standard 3 sided system including rails, clamps, fasteners, gate at railing opening, and accessories required for a complete installation; non-penetrating attachment to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Specification based on Babcock Davis, Inc. Safety Railing System, Equal products by Simplified Safety (Kee Hatch) will be acceptable.
- B. Rails to be 1-1/4" I.D. Schedule 40 steel pipe with ASTM A53 galvanized finish.
- C. Pipe caps to be 1-1/2" deep vinyl.
- D. Hardware to be hex head bolts, grade Z zinc plated.
- E. Self-closing gate: 1-1/2" nominal diameter steel tubing, zinc plated, with 316 type SST hardware.

2.5 LADDER SAFETY POST

- A. Furnish and install where indicated on plans ladder safety post. The ladder safety post shall be pre-assembled from the manufacturer.
- B. Performance characteristics.
 - 1. Fabricate post to comply with OSHA 1910.27 for fixed ladders. Must support 200 pound load.
 - 2. Tubular post shall lock automatically when fully extended.
 - 3. Safety post shall have controlled upward and downward movement.
 - 4. Release lever shall disengage the post to allow it to be returned to its lowered position.
 - 5. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1 3/4" diameter.
- C. Post: Shall be manufactured of high strength tubing. A pull loop shall be provided at the end of the post to facilitate raising the post.
- D. Material of construction: Steel.
- E. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
- F. Hardware: All mounting hardware shall be Type 316 stainless steel.
- G. Finishes: Factory finish shall be hot dip galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
- C. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

- A. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07720

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for the following types of fire-resistance-rated assemblies:
 - 1. Walls and partitions.
 - 2. Smoke barriers.

1.2 PERFORMANCE REQUIREMENTS

- A. F-Ratings: Provide firestop systems with F-ratings equaling or exceeding fire-resistance rating of constructions penetrated as determined per ASTM E 814.
- B. T-Ratings: Provide firestop systems with T-ratings required, as well as F-ratings, determined per ASTM E 814, where systems protect penetrating items with potential to contact adjacent materials in occupiable floor areas including, but not limited, to the following:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.
 - 3. Penetrations located in construction containing fire-protection-rated openings.
 - 4. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
- C. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread indices of less than 25 and smoke-developed indices of less than 450, when tested per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Include details of installation and design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
- C. Product certificates test reports.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide rated systems identical to those tested per ASTM E 814 and with products bearing the classification marking of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated on Drawings.
 - 1. A/D Fire Protection Systems Inc.
 - 2. DAP Inc.
 - 3. Firestop Systems Inc.
 - 4. Hilti Construction Chemicals, Inc.
 - 5. Instant Firestop Mfg. Inc.
 - 6. International Protective Coatings Corp.
 - 7. Isolatek International.
 - 8. Nelson Firestop Products.
 - 9. NUCO Industries.
 - 10. RectorSeal Corporation (The).
 - 11. Specified Technologies Inc.
 - 12. 3M Fire Protection Products.
 - 13. Tremco.
 - 14. United States Gypsum Company.

2.2 FIRESTOP SYSTEMS

- A. Compatibility: Provide firestop systems that are compatible with the substrates forming openings, and with the items, if any, penetrating firestop systems, under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Accessories: Provide accessories required to install fill materials that comply with requirements of tested assemblies, are approved by qualified testing and inspecting agency that performed

testing, and are specified by manufacturer of tested assemblies. Accessories include, but are not limited to, the following:

1. Permanent forming/damming/backing materials.
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Clean openings immediately before installing firestop systems.
 1. Remove foreign materials that could interfere with adhesion of firestop systems.
 2. Remove laitance and form-release agents from concrete.
 3. Produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.
- C. Priming: Prime substrates when recommended in writing by firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not spill primers or allow them to migrate onto adjoining surfaces.
- D. Masking Tape: Use masking tape where required to prevent contact of firestopping with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove firestopping smears. Remove tape immediately after installation without disturbing firestopping seal.
- E. Accessories: Install accessories of types required to support fill materials during their application and in the position necessary to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials, remove combustible forming materials and other accessories that are not permanent components of firestop systems.
- F. Install fill materials for firestop systems by proven techniques.

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- G. Clean excess fill materials adjacent to openings as installation progresses by methods and with cleaning materials that are approved in writing by manufacturers and that do not damage materials in which openings occur.

END OF SECTION 07841

SECTION 07843 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Grabber Construction Products.
 - d. Hilti, Inc.
 - e. Nelson Firestop; a brand of Emerson Industrial Automation.
 - f. NUCO Inc.
 - g. Passive Fire Protection Partners.
 - h. RectorSeal.
 - i. ROCKWOOL (ROXUL Inc.).
 - j. Specified Technologies, Inc.
 - k. Thermafiber, Inc.; an Owens Corning company.
 - l. Tremco, Inc.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Industrial Insulation Group, LLC (IIG-LLC).
 - d. Nelson Firestop; a brand of Emerson Industrial Automation.
 - e. NUCO Inc.
 - f. RectorSeal.
 - g. ROCKWOOL (ROXUL Inc.).
 - h. Specified Technologies, Inc.
 - i. Thermafiber, Inc.; an Owens Corning company.
 - j. Tremco, Inc.

 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Hilti, Inc.
 - d. Nelson Firestop; a brand of Emerson Industrial Automation.
 - e. NUCO Inc.
 - f. Passive Fire Protection Partners.
 - g. RectorSeal.
 - h. ROCKWOOL (ROXUL Inc.).
 - i. Specified Technologies, Inc.
 - j. Thermafiber, Inc.; an Owens Corning company.
 - k. Tremco, Inc.

 2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078443

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in vertical surfaces and horizontal non-traffic surfaces.
 - 2. Interior joints in vertical surfaces and horizontal non-traffic surfaces.
- B. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Preconstruction field test reports.
- D. Compatibility and adhesion test reports.
- E. Product certificates, test reports.

1.4 QUALITY ASSURANCE

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles or approved equal.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Acid-Curing Silicone Sealant :

1. Available Products:

- a. Dow Corning Corporation; 999-A.
- b. GE Silicones; Construction SCS1200.
- c. Pecora Corporation; 860.
- d. Polymeric Systems Inc.; PSI-601.
- e. Tremco; Proglaze.
- f. Tremco; Tremsil 200.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Available Products:

- a. Pecora Corporation; 898.
- b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (non-sag).

3. Class: 25.

4. Use Related to Exposure: NT (non-traffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

F. Multi-component Non-sag Urethane Sealant:

1. Available Products:

- a. Bostik Findley; Chem-Calk 500.
- b. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Gun Grade).
- c. Polymeric Systems Inc.; PSI-270.
- d. Tremco; Dymeric.
- e. Sonneborn NP2.

2. Type and Grade: M (multicomponent) and NS (nonsag).

3. Class: 25.

4. Additional Movement Capability: 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.

5. Use Related to Exposure: NT (nontraffic).

6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Available Products:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 2. Remove laitance and form-release agents from concrete.
 - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.
 - 1. Joint Sealant: Multicomponent nonsag urethane sealant.
- B. Joint-Sealant Application: Exterior perimeter joints between different materials listed above and frames of doors, windows, and louvers.
 - 1. Joint Sealant: Multicomponent nonsag urethane sealant.
- C. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
 - 1. Joint Sealant: Single-component nonsag urethane sealant.
- D. Joint-Sealant Application: Interior perimeter joints of exterior openings.
 - 1. Joint Sealant: Single-component nonsag urethane sealant.
- E. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
 - 1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.

- F. Joint-Sealant Application: Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - 1. Joint Sealant: Silicone-based solvent-release joint sealant.

- G. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - 1. Joint Sealant: Silicone-based solvent-release joint sealant.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard hollow metal doors and frames.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Samples for Verification: For each type of exposed finish required.
- D. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.3 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure, as close to neutral pressure as possible according to NFPA 252.
 - 1. Temperature-Rise Limit: Where indicated and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an Assa Abloy Group company.

4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Firedoor Corporation.
7. Fleming Door Products Ltd.; an Assa Abloy Group company.
8. Habersham Metal Products Company.
9. Kewanee Corporation (The).
10. Mesker Door Inc.
11. Pioneer Industries, Inc.
12. Security Metal Products Corp.
13. Steelcraft; an Ingersoll-Rand company.
14. Windsor Republic Doors.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I.
- G. Glazing: Division 8 Section "Glazing."
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Comply with ANSI/SDI A250.8.
 1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.

5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 1. Level 1 and Physical Performance Level C (Standard Duty), Model 2 (Seamless).
 - a. Width: 1-3/4 inches.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8.
- B. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
 1. Fabricate frames with mitered or coped corners.
 2. Fabricate frames as full profile welded unless otherwise indicated.
 3. Frames for Level 1 Steel Doors: 0.042-inch thick steel sheet.
 4. Frames for Wood Doors: 0.067-inch thick steel sheet.
 5. Frames for Borrowed Lights: 0.067-inch thick steel sheet.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, same material as door face sheet.

- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

2.7 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
 - 1. Glazed Lites: Factory cut openings in doors.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches high.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 - 7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
 - a. Single-Door Frames: Three door silencers.
 - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 electrical Sections.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 3. Provide loose stops and moldings on inside of hollow metal work.
 4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: ANSI/SDI A250.10.

2.9 TORNADO-RESISTANT HOLLOW-METAL DOORS AND FRAMES

- A. Product: Steelcraft PW14 Paladin Series flush door, tested and factory labeled for compliance with FEMA 361/320 guidelines and ANSI ICC500 standards, and furnished as an assembly with Steelcraft FP14 frame and with tested door hardware specified in Section 087100.
- B. Construct tornado-resistant doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- C. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
1. Doors:
 - a. Steel stiffened core construction with 0.042 inch stiffeners welded to each face sheet.
 - b. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
 - c. Edge Construction: Full height, epoxy filled mechanical interlock edges at lock and hinge edges with edge seams welded, filled and ground smooth for the full height of the door. Provide full height lock side reinforcement channel. Bevel lock and hinge edge.

- d. Provide inverted top and bottom channels minimum of thickness 0.067 inch with additional flush channel of minimum 0.093 inch thickness.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch with minimum A60 coating.
 - b. Construction: Knocked down.
3. Exposed Finish: Factory applied baked-on rust inhibiting primer paint in accordance with ANSI A250.10-1998 (R2004)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- C. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.

B. Related Sections:

1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.3 QUALITY ASSURANCE

A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure or as close to neutral pressure as possible according to NFPA 252.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Specific products or materials manufactured by any of the following listed manufacturers are “acceptable”, (not approved) only if the specific product of material can evidence exact compliance with the contract.
 - 1. Masonite Architectural, Marshfield, Wisconsin.
 - 2. VT Industries Inc., Holstein, Iowa.

2.2 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade:
 - 1. Extra Heavy Duty: Unless otherwise specified.
- B. Interior Flush, Bonded Core Doors:
 - 1. WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf
- C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated. Doors shall comply with the same levels as non-rated doors.
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 3. PDC shall decide if hardware blocking reinforcements are preferred over throughbolting.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade AA faces.
 - 2. Species: Red Oak
 - 3. Cut: Quarter Sawn
 - 4. Match between Veneer Leaves: Book match.
 - 5. Assembly of Veneer Leaves on Door Faces: Balance match.
 - 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - 7. Core: Structural composite lumber.
 - 8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

- A. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section "Glazing."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI catalyzed polyurethane system.
 - 3. Staining: Match existing.
 - 4. Effect: Filled finish.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Interior Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 08211

SECTION 08311 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes access doors and frames.

1.2 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors and frames.

1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Factory-Primed Finish: Manufacturer's standard shop primer.
- D. Drywall Beads: 0.0299-inch (0.76-mm) zinc-coated steel sheet to receive joint compound.
- E. Manufacturer's standard finish.

2.2 ACCESS DOORS AND FRAMES FOR WALLS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Acudor Products, Inc.
 2. Babcock-Davis; A Cierra Products Co.
 3. Bar-Co, Inc. Div.; Alfab, Inc.
 4. Cendrex Inc.
 5. Dur-Red Products.
 6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
 7. Jensen Industries.
 8. J. L. Industries, Inc.
 9. Karp Associates, Inc.
 10. Larsen's Manufacturing Company.
 11. MIFAB, Inc.
 12. Milcor Inc.
 13. Nystrom, Inc.
 14. Williams Bros. Corporation of America (The).
- B. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
1. Locations: Wall surfaces.
 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
 5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
 6. Hinges: Continuous piano.
 7. Automatic Closer: Spring type.
 8. Latch: Self-latching device operated by knurled knob with interior release.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 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 08311

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior aluminum-framed storefronts.
 - 2. Exterior and interior manual-swing aluminum doors.
 - 3. Exterior and interior aluminum door frames.
- B. Related sections include the following:
 - 1. Section 08800 Glazing

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 4. Attached Sunshades
 - 5. Dimensional tolerances of building frame and other adjacent construction.
 - 6. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units to function properly.
- B. Structural Loads:
 - 1. Wind Loads: See Structural Drawings.
- C. Deflection of Framing Members Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

- D. Structural-Test Performance: Systems tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- E. Temperature Change (Range): Systems accommodate 120 deg F, ambient; 180 deg F, material surfaces.
- F. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of systems of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. 6.24 lbf/sq. ft.
- G. Water Penetration Under Static Pressure: Systems do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Condensation Resistance: Fixed glazing and framing areas of systems have condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- I. Average Thermal Conductance: Fixed glazing and framing areas of systems have average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Samples: For each exposed finish.
- D. Product test reports.
- E. Field quality-control test and inspection reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Acceptable to manufacturer and capable of preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

- B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

1.5 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.
 - f. Failure of operating components to function properly.
- 2. Warranty Period: 10 years from date of Substantial Completion.

- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

- 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide Tri Fab 450T storefront system by Kawner or comparable product by one of the following or approved equal:

- 1. EFCO, 402 & 403
- 2. Tubelite Inc., T1400 & E1400
- 3. Kawneer, 451 & 451T
- 4. YYK, Yes 45TU & 45FL
- 5. Old Castle, 3000MP & FG3000
- 6. US Aluminum, IT451 & 4515F

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

- 1. Sheet and Plate: ASTM B 209.
- 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: High-performance plastic connectors separate framing members exposed to the exterior from members exposed to the interior.
2. Framing shall accommodate aluminum sunshades.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 DOORS

- A. Doors: Manufacturer's standard glazed doors, for manual swing operation.
 - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Wide Stile.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
- B. Scheduled Door Hardware: Provide door hardware according to the Door Hardware Schedule at the end of Part 3.
 - 1. Named Manufacturer's Products: Product designation and hardware manufacturer are listed in the Door Hardware Schedule at the end of Part 3 to establish minimum requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware.
 - a. Provide one of the named hardware manufacturer's products.
- C. Cylinders: As specified in Division 8 Section "Door Hardware."
- D. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

- F. Silencers: BHMA A156.16, Grade 1.

2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 8 Section "Glazing."
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- C. Sunshades: Provide 32" arms.

2.8 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from interior for vision glass and for spandrel glazing or panels.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
- F. Doors: Reinforce doors as required for installing hardware.
 - 1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Color: Clear Anodized

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Fit joints to produce hairline joints free of burrs and distortion.
2. Rigidly secure nonmovement joints.
3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
4. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

- D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

- E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

- F. Install glazing as specified in Division 8 Section "Glazing."

- G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

- H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

- I. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 DOOR HARDWARE SCHEDULE: See Section 08710, DOOR HARDWARE

END OF SECTION 08411

SECTION 08710 – DOOR HARDWARE

GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:

- 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
- 2. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
- 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 08 sections for Doors and Frames.
- 4. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
- 5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
- 6. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

- A. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware

- B. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Key Systems and Nomenclature

- C. ANSI - American National Standards Institute
 - 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.
 - 2. ANSI/DHI A115.IG – Installation Guide for Doors and Hardware

- D. ICC – International Code Council, Inc
 - 1. ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities.
 - 2. ICC IBC – International Building Code

- E. NFPA – National Fire Protection Agency
 - 1. NFPA 101 - Life Safety Code
 - 2. NFPA 80 - Fire Doors and Windows

- F. Builders Hardware Manufacturing Association (BHMA)

1.04 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 requirements.
 - 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
 - 3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

- B. Action Submittals:
 - 1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Quantity, type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.
 - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
 - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
4. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
 - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.

- b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.
4. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Factory order acknowledgement numbers (for warranty and service)
 - d. Name, address, and phone number of local representative for each manufacturer.
 - e. Parts list for each product.
 - f. Final approved hardware schedule, edited to reflect conditions as-installed.
 - g. Final keying schedule
 - h. Copies of floor plans with keying nomenclature
 - i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
- G. Keying Conference
1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- H. Pre-installation Conference
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 4. Review sequence of operation for each type of electrified door hardware.
 5. Review required testing, inspecting, and certifying procedures.
- I. Not more than 2 weeks prior to beginning door, frame and hardware installation, installing contractor shall meet with the door hardware manufacturer to review installation and adjustment procedures, as well as UL and NFPA compliance, for all major types (locks, closers and exit devices).
- J. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.07 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.08 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years
 - 2) Electrified: 2 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - c. Locksets:
 - 1) Mechanical: 10 years
 - 2) Electrified: 1 year.
 - d. Continuous Hinges: Lifetime warranty.
 - e. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
 2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
 3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
 4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

- A. Manufacturers and Products:
1. Scheduled Manufacturer and Product: Ives 5BB series.
 2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series.
- B. Requirements:
1. Provide hinges conforming to ANSI/BHMA A156.1.
 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard or heavy weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard or heavy weight, steel, 4-1/2 inches (114 mm) high
 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide minimum three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
9. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Select, Stanley.
2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
 - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
 - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 - d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
 - e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 - f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
 - g. Install hinges with fasteners supplied by manufacturer.
 - h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

- a. Scheduled Manufacturer: Von Duprin EPT-10.

B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND series – No Substitutions.

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99/33A series – No Substitutions

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.

6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Top latch mounting: double or single tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
15. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 CYLINDERS

A. Requirements:

1. Owner to provide SFIC cylinders/cores to match building existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

B. Construction Keying:

- a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
- b. Replace temporary construction cores with permanent cores unless directed otherwise by owner.

2.09 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series – No Substitutions.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.

3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.10 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4600 series.
2. Acceptable Manufacturers and Products: Norton 6000 series, Besam Power Swing.

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide compatible back boxes as required for proper mounting of actuator switches to wall or mullion as indicated.
10. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
11. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence

- operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
12. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.11 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage/Von Duprin PS900 series.

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.12 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.

2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson.
2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead

stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.

4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.17 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer: Schlage.
2. Acceptable Manufacturers: GE-Interlogix, Sargent.

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.18 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores unless directed otherwise by owner.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.03 FIELD QUALITY CONTROL

- A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.
 - 1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:
 - 1. The following hardware sets represent design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Additional hardware may be required for proper installation and use.

Hardware Group No. 01.01

For use on Door #(s):

A101

Provide each PR door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEM D	FINIS H	MFR
1	EA	CONT. HINGE	112XY		US28	IVE
1	EA	CONT. HINGE	112XY EPT		US28	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-99-EO		626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-99-NL-OP-110MD- CON-24VDC	⚡	626	VON
2	EA	MORT CYL HOUSING	AS REQ'D		626	SCH
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
3	EA	SFIC CORE	KEYED CONST CORE		622	SCH
3	EA	PERMANENT CORE	BY OWNER			MED
2	EA	90 DEG OFFSET PULL	8190EZHD 12" O		630- 316	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH MC		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	WEATHER STRIPPING	BY DOOR/FRAME MFR.			UNK
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
1	EA	WIRE HARNESS	CON X LENGTH AS REQ'D			SCH
1	EA	WIRE HARNESS	CON-6W			SCH
2	EA	DOOR CONTACT	7764	⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	⚡	LGR	SCE
2	EA	CLOSER TEMPLATING, BRACKETS, SHOES, SPACERS, ETC	AS REQUIRED			
1			CARD READER BY DIV 28			

OPERATIONAL DESCRIPTION

ACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL AFTER RETRACTING LATCHBOLT WITH KEY. LATCHBOLT CAN BE RETRACTED ELECTRICALLY FOR EITHER MOMENTARY OR EXTENDED PERIODS OF TIME ALLOWING DOOR TO BE PUSH/PULL FUNCTION. ACCESS CONTROL SOFTWARE OR PRESENTING AUTHORIZED CREDENTIAL SHALL RETRACT LATCHBOLT ELECTRICALLY ALLOWING DOOR TO BE OPENED. RX SWITCH MONITORS THE DEPRESSION OF THE PUSHBAR. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

INACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL WHEN DEVICE DOGGED DOWN. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

KEYED REMOVABLE MULLION

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 01.02

For use on Door #(s):

A100A

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEM	FINIS	MFR
Y				D	H	
1	EA	CONT. HINGE	112XY		US28	IVE
1	EA	CONT. HINGE	112XY EPT		US28	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-99-EO		626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-99-NL-OP-110MD- CON-24VDC	⚡	626	VON
2	EA	MORT CYL HOUSING	AS REQ'D		626	SCH
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
3	EA	SFIC CORE	KEYED CONST CORE		622	SCH
3	EA	PERMANENT CORE	BY OWNER			MED
2	EA	90 DEG OFFSET PULL	8190EZHD 12" O		630- 316	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH MC		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	⚡	689	LCN
2	EA	ACTUATOR	8310-853T/8310-818T AS REQ'D	⚡	630	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	WEATHER STRIPPING	BY DOOR/FRAME MFR.			UNK
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
1	EA	WIRE HARNESS	CON X LENGTH AS REQ'D			SCH
1	EA	WIRE HARNESS	CON-6W			SCH
2	EA	DOOR CONTACT	7764	⚡	628	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	⚡	LGR	SCE
2	EA	CLOSER TEMPLATING, BRACKETS, SHOES, SPACERS, ETC	AS REQUIRED			

CARD READER BY DIV 28

OPERATIONAL DESCRIPTION

ACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL AFTER RETRACTING LATCHBOLT WITH KEY. LATCHBOLT CAN BE RETRACTED ELECTRICALLY FOR EITHER MOMENTARY OR EXTENDED PERIODS OF TIME ALLOWING DOOR TO BE PUSH/PULL FUNCTION. ACCESS CONTROL SOFTWARE OR PRESENTING AUTHORIZED CREDENTIAL SHALL RETRACT LATCHBOLT ELECTRICALLY ALLOWING DOOR TO BE OPENED. RX SWITCH MONITORS THE DEPRESSION OF THE PUSHBAR. AUTO OPERATOR - PUSHING EITHER INTERIOR OR EXTERIOR ACTUATOR BUTTON TO CYCLE AUTO OPERATOR AFTER RETRACTING LATCHBOLT ELECTRICALLY. EXTERIOR ACTUATOR BUTTON ONLY ENERGIZED WHEN ACCESS CONTROL SOFTWARE OR AUTHORIZED CREDENTIAL RETRACTS LATCHBOLT ELECTRICALLY.

INACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL WHEN DEVICE DOGGED DOWN. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

KEYED REMOVABLE MULLION

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 02.01

For use on Door #(s):

A100 B100

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEM	FINIS	MFR
Y				D	H	
6	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	⚡	689	VON
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-99-EO		626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-99-NL-OP-110MD- CON-24VDC	⚡	626	VON
2	EA	MORT CYL HOUSING	AS REQ'D		626	SCH
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
3	EA	SFIC CORE	CONST/DISP CORE		622	SCH
3	EA	PERMANENT CORE	BY OWNER			MED
2	EA	90 DEG OFFSET PULL	8190EZHD 12" O		630- 316	IVE
2	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
2	EA	WALL STOP	WS406/407CVX		630	IVE
2	EA	SILENCER HM	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON X LENGTH AS REQ'D			SCH
1	EA	WIRE HARNESS	CON-6W			SCH
2	EA	DOOR CONTACT	679-05HM OR WD AS REQ'D	⚡	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS	⚡	LGR	SCE
1			CARD READER BY DIV 28			

OPERATIONAL DESCRIPTION

ACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL AFTER RETRACTING LATCHBOLT WITH KEY. LATCHBOLT CAN BE RETRACTED ELECTRICALLY FOR EITHER MOMENTARY OR EXTENDED PERIODS OF TIME ALLOWING DOOR TO BE PUSH/PULL FUNCTION. ACCESS CONTROL SOFTWARE OR PRESENTING AUTHORIZED CREDENTIAL SHALL RETRACT LATCHBOLT ELECTRICALLY ALLOWING DOOR TO BE OPENED. RX SWITCH MONITORS THE DEPRESSION OF THE PUSHBAR. SELF-CLOSING,

INACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL AFTER RETRACTING LATCHBOLT WITH KEY. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. SELF-CLOSING,

KEYED REMOVABLE MULLION

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 03.01

For use on Door #(s):

A100B

Provide each PR door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEM D	FINIS H	MFR
2	EA	CONT. HINGE	112XY		US28	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-99-EO		626	VON
1	EA	PANIC HARDWARE	CD-99-NL-OP-110MD		626	VON
3	EA	MORT CYL HOUSING	AS REQ'D		626	SCH
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
4	EA	SFIC CORE	KEYED CONST CORE		622	SCH
4	EA	PERMANENT CORE	BY OWNER			MED
2	EA	90 DEG OFFSET PULL	8190EZHD 12" O		630- 316	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH MC		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	SET	WEATHER STRIPPING	BY DOOR/FRAME MFR.			UNK
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
2	EA	DOOR CONTACT	7764	↗	628	SCE
2	EA	CLOSER TEMPLATING, BRACKETS, SHOES, SPACERS, ETC	AS REQUIRED			

OPERATIONAL DESCRIPTION

ACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL AFTER RETRACTING LATCHBOLT WITH KEY. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

INACTIVE LEAF

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY PULL WHEN DEVICE DOGGED DOWN. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

KEYED REMOVABLE MULLION

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 03.02 WS

For use on Door #(s):

A108

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
2	EA	CONT. HINGE	112XY		US28	IVE
2	EA	PANIC HARDWARE	WS-9927-EO		626	VON
2	EA	OH STOP	90S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA MC ST-2731 TBWMS		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	328AA-S		AA	ZER
2	EA	MEETING STILE	328AA-S		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
2	EA	DOOR CONTACT	679-05HM OR WD AS REQ'D	↗	BLK	SCE

ICC-500 DOOR. DOOR, FRAME AND HARDWARE MUST ALL BE COMPONENTS OF A TESTED ASSEMBLY. INSTALL ALL HARDWARE WITH MANUFACTURER REQUIRED FASTENERS INCLUDING THRU BOLTS FOR MOUNTING CLOSERS AND PANIC DEVICES.

OPERATIONAL DESCRIPTION

BOTH LEAVES

WIND STORM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. EXIT ONLY, NO EXTERIOR TRIM.

SELF-CLOSING. HEAVY DUTY ARM. PUSH SIDE MOUNTED.

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 03.03 WS

For use on Door #(s):

A113

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEM	FINIS	MFR
Y				D	H	
2	EA	CONT. HINGE	112XY		US28	IVE
1	EA	PANIC HARDWARE	WS-9927-EO		626	VON
1	EA	PANIC HARDWARE	WS-9927-L-06		626	VON
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
1	EA	SFIC CORE	KEYED CONST CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
2	EA	OH STOP & HOLDER	90H		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA MC ST-2731 TBWMS		689	LCN
1	EA	RAIN DRIP	142AA		AA	ZER
1	EA	GASKETING	328AA-S		AA	ZER
2	EA	MEETING STILE	328AA-S		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
2	EA	DOOR CONTACT	679-05HM OR WD AS REQ'D	⚡	BLK	SCE

ICC-500 DOOR. DOOR, FRAME AND HARDWARE MUST ALL BE COMPONENTS OF A TESTED ASSEMBLY. INSTALL ALL HARDWARE WITH MANUFACTURER REQUIRED FASTENERS INCLUDING THRU BOLTS FOR MOUNTING CLOSERS AND PANIC DEVICES.

OPERATIONAL DESCRIPTION

ACTIVE LEAF

WIND STORM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY TURNING LEVER UNLESS LOCKED BY KEY. KEY LOCKS AND UNLOCKS LEVER.

SELF-CLOSING. HEAVY DUTY ARM. PUSH SIDE MOUNTED.

SURFACE MOUNTED OVERHEAD STOP AND HOLD OPEN

INACTIVE LEAF

WIND STORM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. EXIT ONLY, NO EXTERIOR TRIM.

SELF-CLOSING. HEAVY DUTY ARM. PUSH SIDE MOUNTED.

SURFACE MOUNTED OVERHEAD STOP AND HOLD OPEN

DOOR POSITION SWITCH(S) MONITOR WHETHER THE DOOR IS OPEN OR CLOSED.

Hardware Group No. 04.01

For use on Door #(s):

A102 A103 B105 B202

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

OPERATIONAL DESCRIPTION

FREE EGRESS AND ENTRY AT ALL TIMES BY PUSH PLATE OR PULL. NON-LOCKING, NON-LATCHING. SELF CLOSING.

Hardware Group No. 05.01

For use on Door #(s):

C109

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

PASSAGE LOCK – NEITHER LEVER LOCKABLE. BOTH LEVERS ALWAYS FREE FOR IMMEDIATE INGRESS OR EGRESS.

Hardware Group No. 06.01

For use on Door #(s):

A105

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	ND40S RHO		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

OPERATIONAL DESCRIPTION

PRIVACY LOCK - PUSH-BUTTON LOCKING. WHEN LOCKED, CAN BE OPENED FROM OUTSIDE WITH SMALL SCREWDRIVER. TURNING INSIDE LEVER OR CLOSING DOOR RELEASES BUTTON. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

Hardware Group No. 06.02

For use on Door #(s):

A110 A111 C107 C108

Provide each SGL door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEM D	FINIS H	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CORRIDOR LOCK WITH IND	L9456BD 06A L583-363 L283- 722		630	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

OPERATIONAL DESCRIPTION

CORRIDOR LOCK - LATCHBOLT RETRACTED BY LEVER FROM EITHER SIDE. DEADBOLT THROWN OR RETRACTED BY KEY OUTSIDE OR INSIDE THUMBTURN. THROWING DEADBOLT LOCKS OUTSIDE LEVER. TURNING INSIDE LEVER SIMULTANEOUSLY RETRACTS DEADBOLT AND LATCHBOLT AND UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS FREE FOR EGRESS.VISUAL INDICATOR DISPLAYS OCCUPIED/VACANT ON OUTSIDE FACE OF DOOR. SELF CLOSING.

Hardware Group No. 07.01

For use on Door #(s):

A104

Provide each SGL door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEM D	FINIS H	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

OFFICE LOCK - TURN/PUSH-BUTTON LOCKING; PUSHING AND TURNING BUTTON LOCKS OUTSIDE LEVER, REQUIRING USE OF KEY UNTIL BUTTON IS MANUALLY UNLOCKED. PUSHBUTTON LOCKING; PUSHING BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED BY KEY OR BY TURNING INSIDE LEVER. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

Hardware Group No. 07.02

For use on Door #(s):

C106

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

OFFICE LOCK - TURN/PUSH-BUTTON LOCKING; PUSHING AND TURNING BUTTON LOCKS OUTSIDE LEVER, REQUIRING USE OF KEY UNTIL BUTTON IS MANUALLY UNLOCKED. PUSHBUTTON LOCKING; PUSHING BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED BY KEY OR BY TURNING INSIDE LEVER. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. SELF CLOSING.

Hardware Group No. 08.01

For use on Door #(s):

A107

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
6	EA	HINGE	5BB1 4.5 X 4.5		630	IVE
2	EA	MANUAL FLUSH BOLT WD	FB358		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
2	EA	OH STOP & HOLDER	100H		630	GLY
1	EA	SURFACE CLOSER	4040XP MC ST-1630		689	LCN
2	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

ACTIVE LEAF

CLASSROOM LOCK - OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. SELF CLOSING.

SURFACE MOUNTED OVERHEAD STOP WITH HOLD OPEN

INACTIVE LEAF

MANUAL FLUSH BOLTS.

SURFACE MOUNTED OVERHEAD STOP WITH HOLD OPEN

Hardware Group No. 08.02

For use on Door #(s):

A109

Provide each PR door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEMI D	FINIS H	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		630	IVE
2	EA	MANUAL FLUSH BOLT WD	FB358		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	OH STOP & HOLDER	90H		630	GLY
1	EA	SURFACE CLOSER	4040XP SHCUSH MC		689	LCN
2	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

ACTIVE LEAF

CLASSROOM LOCK - OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. SELF CLOSING. SPRING STOP AND HOLD OPEN INCLUDED.

INACTIVE LEAF

MANUAL FLUSH BOLTS.

SURFACE MOUNTED OVERHEAD STOP WITH HOLD OPEN

Hardware Group No. 08.03

For use on Door #(s):

C106A

Provide each SGL door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEMI D	FINIS H	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

CLASSROOM LOCK - OUTSIDE LEVER LOCKED AND UNLOCKED BY KEY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS.

Hardware Group No. 09.01

For use on Door #(s):

A106 B106 C105

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

STOREROOM LOCK - OUTSIDE LEVER FIXED. ENTRANCE BY KEY ONLY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. SELF-CLOSING.

Hardware Group No. 09.02

For use on Door #(s):

A112

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	CD-99-L-NL-06		626	VON
1	EA	MORT CYL HOUSING	AS REQ'D		626	SCH
1	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
2	EA	SFIC CORE	CONST/DISP CORE		622	SCH
2	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP SCUSH MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

RIM EXIT DEVICE. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY FIXED LEVER AFTER RETRACTING LATCHBOLT WITH KEY. LEVER ALWAYS FIXED. DOGGING BY KEYED CYLINDER LOCKS DOWN THE PUSHBAR SO THE LATCHBOLT REMAINS RETRACTED AND DOOR FUNCTIONS AS A PUSH/PULL. DEVICE IS EITHER DOGGED DOWN (UNLOCKED) OR UNDOGGED (LOCKED). SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

Hardware Group No. 09.03

For use on Door #(s):

C113A

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD RHO		626	SCH
1	EA	SFIC CORE	CONST/DISP CORE		622	SCH
1	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP SCUSH MC		689	LCN
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

STOREROOM LOCK - OUTSIDE LEVER FIXED. ENTRANCE BY KEY ONLY. INSIDE LEVER ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE EGRESS. SELF-CLOSING. SPRING LOADED STOP INCLUDED. PUSH SIDE MOUNTED.

Hardware Group No. 10.01 WS

For use on Door #(s):

A108A A108B

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	ITEMI	FINIS	MFR
Y				D	H	
2	EA	CONT. HINGE	112XY		US28	IVE
2	EA	PANIC HARDWARE	WS-9927-L-06		626	VON
2	EA	RIM CYL HOUSING	AS REQ'D		626	SCH
2	EA	SFIC CORE	CONST/DISP CORE		622	SCH
2	EA	PERMANENT CORE	BY OWNER			MED
2	EA	SURFACE CLOSER	4040XP SHCUSH MC TBWMS		689	LCN
2	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	THRESHOLD	655A-223		A	ZER
2	EA	SILENCER HM	SR64		GRY	IVE

ICC-500 DOOR. DOOR, FRAME AND HARDWARE MUST ALL BE COMPONENTS OF A TESTED ASSEMBLY. INSTALL ALL HARDWARE WITH MANUFACTURER REQUIRED FASTENERS INCLUDING THRU BOLTS FOR MOUNTING CLOSERS AND PANIC DEVICES.

OPERATIONAL DESCRIPTION

BOTH LEAVES

WIND STORM EXIT DEVICE WITH SURFACE MOUNTED RODS. FREE EGRESS AT ALL TIMES BY PRESSING PUSHBAR. ENTRY BY TURNING LEVER UNLESS LOCKED BY KEY. KEY LOCKS AND UNLOCKS LEVER.

SELF-CLOSING. SPRING LOADED STOP & HOLD OPEN

Hardware Group No. 10.02

For use on Door #(s):

C110

Provide each SGL door(s) with the following:

QT Y		DESCRIPTION	CATALOG NUMBER	ITEMI D	FINIS H	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM SECURITY	ND75BD RHO XN12-035		626	SCH
2	EA	SFIC CORE	CONST/DISP CORE		622	SCH
2	EA	PERMANENT CORE	BY OWNER			MED
1	EA	SURFACE CLOSER	4040XP RW/PA MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER HM	SR64		GRY	IVE

OPERATIONAL DESCRIPTION

CLASSROOM SECURITY LOCK - KEY IN EITHER LEVER LOCKS OR UNLOCKS OUTSIDE LEVER.
INSIDE LEVER IS ALWAYS UNLOCKED. INSIDE LEVER IS ALWAYS FREE FOR IMMEDIATE
EGRESS.
SELF-CLOSING.

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Storefront framing.
 - 3. Glazed entrances.
 - 4. Interior borrow lites.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 or ICC's 2009 International Building Code by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: Comply with applicable governing codes.
 - 2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.6 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

2.3 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. PPG Industries, Inc.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 1. Sealing System: Dual seal.
 2. Spacer: Manufacturer's standard spacer material and construction.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

- A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 INSULATING-GLASS TYPES

- A. Glass GL-2: Clear Low-E-coated, insulating glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: ¼ inch.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Low-E Coating: Pyrolytic or sputtered on second surface.
 - 7. Provide safety glazing labeling.
 - 8. U-Value: 0.22 maximum.

- B. Glass GL-3: Low-E-coated, spandrel insulating glass. (Clear outboard lite with clear inboard lite with low E coating on #2 surface.)
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: ¼ inch.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass, etched on third surface and charcoal frit on fourth surface.
 - 6. Low-E Coating: Pyrolytic or sputtered on second surface.
 - 7. Provide safety glazing labeling.

2.9 MONOLITHIC-GLASS TYPES

- A. Glass GL-1: Clear heat-strengthened or fully tempered float glass. (See drawings for specific locations).
 - 1. Thickness of glass: ¼ inch.
 - 2. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08800

SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, and suspended soffits).

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide interior metal suspension systems capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As follows:
 - a. Dead Loads: Weights of materials and construction.
 - b. Seismic Loads: As required by local Codes

1.3 SUBMITTALS

- A. Product Data: For each type of product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of metal suspension system components; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 1. For interior suspension systems, comply with design loads, including structural analysis data signed and sealed by the qualified professional structural engineer (hired by this Contractor) responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
- E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2 ½ -inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top

- runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Firestop Track: As specified in Division 7 Section "Fire-Resistive Joint Systems."
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
- E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
 2. Depth: As indicated on Drawings.

2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

B. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09111

SECTION 09250 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Exterior aluminum vents for ceilings and soffits.
 - 4. Metal suspension system for ceilings and soffits.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 1. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- 2. Interior suspended ceilings and soffits: Maximum deflection of 1/360 of distance between supports.
- 3. Exterior soffits: Withstand minimum positive and negative pressure of 20 psf with maximum deflection of 1/360 of distance between supports.
- 4. Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum Co.

- b. CertainTeed.
- c. Georgia-Pacific Gypsum, LLC.
- d. Lafarge North America Inc.
- e. National Gypsum Company.
- f. PABCO Gypsum.
- g. Temple-Inland.
- h. USG Corporation.

B. Regular Type: ASTM C 1396/C 1396M.

- 1. Thickness: As shown on Drawings.
- 2. Long Edges: Tapered.

C. Type X:

- 1. Thickness: As shown on Drawings.
- 2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

- 1. Thickness: As shown on Drawings.
- 2. Long Edges: Tapered.

E. Abuse-Resistant Type: ASTM C 1629/C 1629M. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type.

- 1. Core: As indicated on Drawings, equal to Fiberock by USG.
- 2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces and equal to Aqua-Tough by USG.

- 1. Core: As shown on Drawings.
- 2. Long Edges: Tapered.
- 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

- 1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by Georgia-Pacific Gypsum.
- 2. Core: As indicated.

2.4 CEILING AND SOFFIT SUPPORT MATERIALS

A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or by certified test data.

- B. Powder-Actuated Fasteners in Concrete: Fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers [and with capability to sustain, without failure, a load equal to 10x calculated loads].
- C. Hangers:
 - a. Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceiling or soffit area and loads to be supported.
 - b. Wire: ASTM A 641, soft, Class 1 galvanized.
 - c. Rods and flats:
 - i. Mild steel components.
 - ii. Finish: Galvanized or painted with rust-inhibitive paint for interior work; galvanized for exterior work.
- D. Framing System:
 - a. Main runners:
 - 1. Cold-rolled, "C" shaped steel channels, 16 gauge minimum.
 - 2. Finish: Galvanized with G40 hot-dip galvanized coating per ASTM A525 [for exterior work]; galvanized or painted with rust-inhibitive paint for other interior work.
 - 3. Form to required radius at curved ceilings.
 - b. Cross furring: Hat-shaped steel furring channels, ASTM C645, 7/8 inch high, 25 gauge, galvanized.
 - c. Furring anchorages: 16 gauge galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws recommended by furring manufacturer and complying with ASTM C754.
 - d. Provide compression posts and other accessories as required to comply with seismic requirements.
- E. Proprietary Framing System:
 - 1. Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635, with exposed surfaces finished in manufacturer's standard enamel paint finish.
 - 2. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
 - 3. Accessories:
 - a. U-shaped channel molding.
 - b. Galvanized carbon steel (12 ga.) hanger wire.
 - 4. Acceptable product: Equivalent to Drywall Suspension System by USG.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.

C. Exterior Vent Louvers for Ceilings and Soffits:

1. Aluminum Vent Louver: Equal to Model DCS-XX-V-300 (thickness as required) as manufactured by Fry Reglet Corporation. Aluminum shall be 6063 T5 extruded alloy.
 - a. Finish: Clear Anodized Aluminum
 - b. Accessories: Insect Screen
 - c. Reveal Width: 3"

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from rock wool. Fiberglass batts will not be acceptable. Acceptable products are Therma Fiber, SAFB, Fibrex, and Roxul.
 1. Density: 2.5pcf
 2. Flame Spread: 0
 3. Smoke Developed: 0
- D. Acoustical Joint Sealant: As specified in Division 7 Section "Joint Sealants".
- E. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 METAL SUPPORT INSTALLATION

A. Ceiling and Soffit Support Systems:

1. Secure hangers or rods to structural support by connecting directly to structure where possible; otherwise connect to inserts, clips or other anchorage devices or fasteners indicated.

2. Space main runners, hangers and furring according to requirements of ASTM C754, except as otherwise indicated.
3. Where spacing of structural members, or width of ducts or other equipment, prevents regular spacing of hangers, provide supplemental hangers and suspension members and reinforce nearest affected hangers to span extra distance.
4. Attach directly to structural elements only; do not attach to metal deck. Loop hangers and wire-tie directly or provide anchors or inserts.
5. Install compression posts, splay wires and other accessories as required to comply with seismic requirements.
6. Extend runners to within 6 inches of walls.
7. Wire-tie or clip furring members to main runners and to other structural supports indicated. In fire resistance rated assemblies, wire-tie furring members; do not clip.
8. Do not permit furring or runners to contact masonry or concrete walls.
9. Provide 1 inch clearance between furring or runners and abutting walls and partitions.
10. For proprietary framing system, comply with manufacturer's instructions.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Regular Type: As indicated on Drawings.
 2. Type X: As indicated on Drawings.
 3. Ceiling Type: As indicated on Drawings.
 4. Abuse-Resistant Type: As indicated on Drawings.
 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
- D. Exterior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250

SECTION 09355 - GLASS TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass tile.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 07920 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 09290 "Gypsum Board".

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.2 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- C. Samples for Verification:
 - 1. Full-size units of each type.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of each type of glass tile installation.
 - 2. Approved mockups may become part of the completed Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.2 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Glass Tile Standard: Provide glass tile that complies with ANSI A137.2 for types and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

- A. Glass Tile Type GWT-1: Large format glass tile.
 - 1. Face Size: As indicated on drawings.
 - 2. Tile Color and Pattern: As indicated on drawings.
 - 3. Grout Color: As indicated on drawings.

2.3 TILE BACKING PANELS

- A. Greenboard Units: In maximum lengths available to minimize end-to-end butt joints.
 - 1. Thickness: As indicated on drawings.

2.4 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4; white, unless otherwise indicated.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Bostik, Inc.
- b. Laticrete International, Inc.
- c. MAPEI Corporation.
- d. TEC; H. B. Fuller Construction Products Inc.

2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

- a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GLASS TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Large Format Glass Tile: 1/16 inch (1.6 mm).
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Metal Edge Strips: Install at locations indicated.
- I. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.3 TILE BACKING PANEL INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.4 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR GLASS TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Metal Studs or Furring:
 - 1. Glass Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
 - a. Thinset Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.

END OF SECTION 09355

SECTION 09402 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Thin-set, epoxy-resin terrazzo flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer who is a contractor member of NTMA.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- B. FloorScore Compliance: Terrazzo floors shall comply with requirements of FloorScore Standard.
- C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo : Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crossfield Products Corp., Dex-O-Tex Division; Spectrum Terrazzo.
 - b. General Polymers Corporation; Terrazzo 1100.
 - c. Key Resin Company; Key Epoxy Terrazzo.
 - d. Master Terrazzo Technologies LLC; Morricite.
 - e. Quadrant Chemical Corporation; Quadset Epoxy Terrazzo.
 - f. TEC Specialty Construction Brands, Inc.; Tuff-Lite Epoxy Terrazzo.
 - g. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.
 - 2. Thickness: as necessary to match existing floor.
 - 3. Mix Color and Pattern: as selected and approved by architect to match the adjacent field of existing terrazzo at patch areas. See architectural drawings for Mix color and Pattern for new floors and existing floor patch areas.
- B. Materials:
 - 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
 - 2. Primer: Manufacturer's product recommended for substrate and use indicated.
 - 3. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:
 - 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.

- 2) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D 412.
 - 3) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
 - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - a) Distilled water.
 - b) Mineral water.
 - c) Isopropanol.
 - d) Ethanol.
 - e) 0.025 percent detergent solution.
 - f) 1.0 percent soap solution.
 - g) 10 percent sodium hydroxide.
 - h) 10 percent hydrochloric acid.
 - i) 30 percent sulfuric acid.
 - j) 5 percent acetic acid.
- b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
- 1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch (6.35 mm) per ASTM D 635.
 - 2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to plus 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.
4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
- a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
5. Finishing Grout: Resin based.

2.3 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle, 1/4 inch (6.4 mm) deep.
 1. Material: Zinc.
 2. Top Width: -to match existing.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.

2.4 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.
 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Strip Anchoring Devices: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.
- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
 2. Acid-Base Properties: With pH factor between 7 and 10.
 3. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

- a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

Include in the base bid, the installation of Moisture Vapor Mitigation Treatment as recommended by Resinous Matrix Terrazzo Flooring Manufacturer.

3.2 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Place according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
- C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6.4 mm in 3 m); noncumulative.
- D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- E. Strip Materials:
 - 1. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated.
 - b. Install control-joint strips back to back directly above concrete-slab control joints>.
 - c. Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - 2. Accessory Strips: Install as required to provide a complete installation.
- F. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.3 CLEANING, RESTORATION, AND PROTECTION

- A. Cleaning/ Restoration:
 - 1. Refer to NTMA Technical Bulletin of cracks in existing terrazzo flooring.

2. Remove grinding dust from installation and adjacent areas.
3. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
4. Machine Clean and strip terrazzo floors with arsenal stripper by Hillyard and 120 grit 3M silicone screens and razor blade strip all edges.
5. Flush floor with neutral rinse by Hillyard.
6. Diamond hone floor with 50, 120, and 220 grit diamond resin pads.
7. Blow floor dry.
8. Apply 3 coats of sealer.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations-3 coats.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09402

SECTION 09651 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl composition tile (VCT).
 - 2. Rubber floor tile (RT).

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: Full-size units of each color and pattern of resilient floor tile required.
- C. Maintenance data.

1.3 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE

- A. VCT-1: ASTM F 1066, Class 2, through-pattern tile.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Armstrong, Standard Excelon.
 - 2. Color and Pattern: See finish and materials list on drawings.
 - 3. Thickness: 0.125 inch.
 - 4. Size: 12 by 12 inches. Note: All tile grain shall run the same direction.
 - 5. FloorScore IAQ Compliant.
 - 6. Fire-Test-Response Characteristics:
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement-based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.
 - 1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

4. Include in the base bid, the installation of “Moisture Vapor Mitigation Treatment” as recommended by Vinyl Composition Tile Flooring Manufacturer.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates to produce a uniform and smooth substrate.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer’s written instructions for installing floor tile.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 1. Lay tiles square with room axis.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- I. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09651

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RB-1)

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

- a. Johnsonite.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TP (rubber, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: As indicated on Drawings.
- C. Minimum Thickness: 0.080 inch
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Finish: As indicated on drawings.
- I. Colors and Patterns: As indicated on drawings.

2.2 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.
 - a. Johnsonite.
- B. Description: As indicated on drawings.
- C. Material: Rubber.
- D. Profile and Dimensions: As indicated.
- E. Colors and Patterns: As indicated on drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Cove Base Adhesives: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

END OF SECTION 09653

SECTION 09656 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet vinyl resilient athletic flooring.
2. Floor moisture mitigation is included in base bid.

1.2 BASE BID

- ##### A. BASE BID: Provide manufacturer's flooring system with full-spread high moisture adhesive capable of tolerating slab moisture exposure up to 98 percent relative humidity when tested according to ASTM F 2170.

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product indicated.

B. Manufacturer Certifications:

1. Provide certification that accurately identifies the Original Equipment Manufacturer (OEM) of flooring furnished for this project including manufacturer's name, address and factory location.
 - a. Suppliers of Private-Label flooring for this project must identify themselves as such and fully disclose the OEM information listed above.
 - b. All "manufacturer" requirements in these specifications must be complied with by the OEM, including warranties, certifications, qualifications, product data, test results, environmental requirements, performance data, etc.
2. Provide ISO 9001 certification for the OEM of the specified products.
3. Provide ISO 14001 certification for the OEM of the specified products.

C. Laboratory Test Results:

1. Provide certification of testing per ASTM F2772-11 and the product being furnished complies with the ASTM Indoor Sport Floor Classification specified for this project. Third-party certification required; sales literature is not sufficient.

- ##### D. Shop Drawings: Showing installation details and locations of borders, patterns, game lines, locations of floor inserts and seams.

E. Samples:

1. Manufacturer's color chart for selection of available floors with a minimum of 10 standard colors available, including 2 wood visuals.
2. Color samples:
 - a. Wood visual samples Minimum 24 inches by 36 inches to show that the appearance of wood plank pattern complies with these specifications
 - b. Solid color samples: Minimum 6 inches by 8 inches.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For a qualified resilient athletic flooring Manufacturer.
2. For a qualified resilient athletic flooring Installer.

1.5 CLOSEOUT SUBMITTALS

A. Submit three copies of the following:

1. Manufacturer maintenance instructions.
2. Manufacturer material warranty.
3. Installer installation warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. ISO 9001 Certified.
2. ISO 14001 Certified.
3. At least ten years active experience in the manufacture and marketing of indoor resilient athletic flooring. A minimum of 10 installations within 50 miles of this job.
4. A provider of authorized installer training.

B. Installer Qualifications:

1. At least five years experience in the installation of resilient athletic flooring.
2. Experience on at least five projects of similar size, type and complexity as this project within 50 miles of job site.

3. Proper equipment to do professional installation including electric router for routing seams and automatic welding machine (robot) for seam welding.
- C. Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.
 - D. Athletic Performance Properties: Comply with ASTM F 2772-11 Performance Level Class 2 for force reduction, ball bounce, vertical deformation and surface friction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (13 deg C) nor more than 85 deg F (29 deg C).
- B. Store the indoor resilient athletic surfacing rolls in an upright position on a smooth flat surface immediately upon delivery to Project.

1.8 FIELD CONDITIONS

- A. Product Installation:
 1. Maintain temperatures during installation within range recommended by manufacturer, but not less than 65 deg F (18 deg C) in spaces to receive flooring one week before installation, during installation, and one week after installation.
 2. After installation, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).
 3. Prohibit traffic during flooring installation and for at least 48 hours after flooring installation.
- B. Install flooring only after other finishing work, including painting and overhead work, has been completed.

1.9 WARRANTY

- A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.
 1. Material warranty must be direct from the product manufacturer.
 - a. Material warranties from separate or third party insurance providers are not valid.
 - b. Material warranties from private label distributors are not valid.
 2. Failures include, but are not limited to, the following:
 - a. Material manufacturing defects.

- b. Surface wear and deterioration to the point of wear-through.
- c. Failure due to substrate moisture exposure:
 - 1) Not to exceed 98 percent relative humidity when tested according to ASTM F 2170.
- 3. Warranty Period:
 - a. For materials: 2 years from date of Substantial Completion.
 - b. For surface wear: 15 years from date of Substantial Completion.
 - c. For moisture vapor emission:
 - 1) 10 years from date of Substantial Completion.
- B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.
 - 1. Warranty Period: 2 years from date of Substantial Completion.

1.10 ENVIRONMENT AND INDOOR AIR QUALITY

- A. Indoor Air Quality Certification:
 - 1. Flooring products must be FloorScore® Certified.
 - a. FloorScore® certification proves compliance with the volatile organic compound emissions criteria of the California Section 01350 standard.
 - b. FloorScore® certification proves compliance with the testing and product requirements of the California Department of Health Services “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”
 - c. FloorScore® documentation must include certificate number for specified product.
 - 2. Manufacturer’s certification of factory applied permanent Bacteriostatic and Fungicidal Treatment throughout the flooring material which can improve indoor air quality and reduce asthma and allergy risks associated with bacterial and mold growth.
- B. Manufacturer Certification of Environmental Procedures:
 - 1. Original Equipment Manufacturer’s (OEM) ISO 14001 Certification

1.11 COORDINATION

- A. Coordinate layout and installation of flooring with other gymnasium equipment.

PART 2 - PRODUCTS

2.1 SHEET VINYL ATHLETIC FLOORING

- A. Basis-of-Design Manufacture: Subject to compliance with requirements, provide
 - 1. BASE BID PRODUCT: Gerflor Taraflex Sport M Plus DRY-TEX Sports Flooring installed with Gerpur high-moisture tolerance full-spread adhesive.
- B. Substitution Limitations:
 - 1. All other manufacturers: Submit formal substitution request 15 days prior to bid in accordance with Section 01600 - "Product Requirements".
 - 2. Approval by Architect of other manufacturers does not relieve Contractor of responsibility to provide products which comply with all requirements of this specification.
- C. Product Description: Dual-durometer foam-backed sheet vinyl flooring designed for fully adhered athletic flooring applications.
 - 1. Overall Thickness: Not less than 0.28 inch (7 mm).
 - 2. Wear-Layer Thickness: Not less than 0.08 inch (2.1 mm)
 - 3. Backing: Very high density, two layer, dual-durometer, closed cell foam with reinforced fiberglass grid.
 - 4. Seaming Method: Heat welded with automatic welder (robot) for long seams.
 - 5. Adhesive Method:
 - a. Full-spread adhesive to completely adhere flooring to substrate.
 - b. Complete adhesive coverage to eliminate the possibility of gaps or space between the slab and flooring material where moisture could accumulate and create an environment conducive to mold growth.
 - c. Flooring to be adhered to the concrete slab in all locations eliminating the possibility of waves or wrinkles forming caused by the floor shifting, moving or by rolling loads displacing it.
 - 6. Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance and Solid colors to have "pebbled" embossed texture for an attractive appearance.
 - 7. Bacteriostatic and Fungicidal Treatment: Manufacturer's factory-applied permanent treatment throughout the flooring material which can improve indoor air quality and reduce asthma and allergy risks associated with bacterial and mold growth.
 - a. Basis-of-Design Product: Gerflor Sanosol

8. Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.
 - a. No-Wax finish: Published product literature identifying factory applied finish as, "No-Wax-Just clean and rinse"
 - b. Basis-of-Design Product: Gerflor ProtecSol.
9. Field-Applied Finishes: None required and not allowed.
10. Roll Size:
 - a. Roll Width: Rolls to be a minimum width of 59 inches (1.5 m) wide.
 - b. Roll Length:
 - 1) Wood visual rolls to be a minimum length of 94 feet with no end seams allowed in playing court to minimize the number of end-seams.
 - 2) Solid color rolls to be a minimum length of 67 feet, 3 inches (20.5 m) to minimize the amount of waste if accent colors are selected for borders, keys or center circle.
 - c. Roll length of wood visual flooring shall be sufficient to cover the full length of a college main basketball court (94'-0") without splicing or end-of-roll (butt) seams within main court boundary.
11. Color and Pattern:
 - a. As selected by Owner from manufacturer's standard colors and patterns.
 - b. Wood pattern shall accurately simulate the true visual appearance of natural athletic wood strip flooring.
 - 1) Pattern shall replicate random-length stock by simulating non-uniform board lengths ranging from 18 inches to 48 inches with a maximum board width of 2-1/2 inches.
 - 2) Wood pattern shall not include a dark line simulating edges or ends of individual boards.
 - 3) Surface texture shall simulate realistic wood grain and not be raised or "pebbled" embossing.

D. Performance Criteria:

1. ASTM F 2772-11 Indoor Sport Floor Standard:
 - a. Provide certification of compliance for the four ASTM F2772 Indoor Sport Floor Standard performance categories:
 - 1) Shock Absorption/Force Reduction:

- a) Class C2 (22% to 33%). Pass
- 2) Ball Bounce:
 - a) Minimum 90%: Pass
- 3) Surface effect/Coefficient of Friction:
 - a) Between 80-110: Pass
- 4) Vertical deformation:
 - a) Maximum 3.5mm: Pass
- 2. Static Load Limit/Residual Indentation:
 - a. ASTM F1303; Pass Static Load Resistance requirement of less than 0.005 inch of residual indentation as tested per ASTM F 970 at prescribed test load of 175 p.s.i.
 - b. EN 1516; Pass, Less than or equal to 0.5 mm.
- 3. Resistance to Rolling Load: EN 1569; Pass.
- 4. Chemical Resistance: ASTM D 543; OK.
- 5. Impact Resistance: EN 1517; Pass.
- 6. Abrasion Resistance: EN ISO 5470; Pass.
- 7. Sound Insulation: EN ISO 717; 18 dB.
- 8. Gloss/Brightness: EN ISO 2813; Pass.
- 9. Organic Emission: ASTM D 5116; Pass
- 10. Fire Performance: ASTM E 648; Greater than 0.45 W/cm², Class 1.
- 11. Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.
- 12. Slab Moisture Design Tolerance:
 - a. PRODUCT: Maximum relative humidity of 98 percent when tested according to ASTM F 2170.

2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by athletic flooring manufacturer.
- B. Adhesive: Water-resistant type recommended by athletic flooring manufacturer for substrate and conditions indicated. Coverage Type: Full-spread application.

1. PRODUCT:
 - a. Basis-of-Design Product: Gerflor Gerpur adhesive for Dry-Tex high moisture system.
 - b. Moisture Resistance: 98 percent relative humidity when tested according to ASTM F 2170.
- C. Heat Welding Rod: As supplied by indoor resilient athletic flooring manufacturer. Color shall blend with resilient athletic flooring color.
- D. Game-Line and Marker Paint: Complete system including primer, compatible with flooring and recommended by flooring and paint manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify the Following:
 1. The area in which the indoor resilient athletic flooring will be installed is dry, weather-tight and in compliance with specified requirements.
 2. Permanent heat, lighting and ventilation systems are installed and operable.
 3. Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.
 4. No foreign materials or objects are present on the substrate and that it is clean and ready for preparation and installation.
 5. Tests to verify that the moisture evaporative rate or substrate relative humidity is within the specified ranges.
 6. The concrete slab surface pH level is within the specified range.
 7. The concrete slab surface deviation is no greater than 1/8 inch within 10 feet (3.2 mm within 3 m) when measured according to ASTM E 1155.
 8. The concrete slab complies with ACI 302.2R for concrete design including use of a low-permeance vapor barrier directly beneath the concrete subfloor with sealed penetrations.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure proper adhesion of resilient athletic flooring system.
- B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of sealers, curing compounds and other additives. Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.
 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are between 7.0 and 8.5.
- C. Moisture Testing: Perform ASTM F 2170 relative humidity test and proceed with installation only after substrates have relative humidity levels below the maximum allowed.
- D. Use trowelable concrete based leveling and patching compound with the same moisture vapor tolerance as the adhesive to fill depressions, holes, cracks, grooves or other irregularities in substrate.
- E. Place flooring and installation materials into spaces where they will be installed at least 48 hours before installation. Install flooring materials only after they have reached the same temperature as space where they are to be installed.
- F. Sand the surface of the concrete slab.
- G. Sweep and then vacuum substrates immediately before installation. After cleaning, examine substrate for moisture, alkaline salts, grit, dust or other contamination. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET ATHLETIC FLOORING INSTALLATION

- A. General:
1. Comply with resilient athletic flooring manufacturer's installation instructions.
 2. Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.
 3. Fit flooring neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
 4. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- B. Lay out flooring as follows:
1. Minimize number of seams and place them inconspicuous areas.
 2. Locate seams as shown on approved Shop Drawings
- C. Adhered Flooring: Attach products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturer instructions.
- D. Vinyl Sheet Flooring Seams: Finish seams to produce surfaces flush with adjoining flooring surfaces. Comply with ASTM F 1516. Rout joints and use heat welding rod to permanently and seamlessly fuse sections together.

3.4 GAME LINES AND LOGOS

- A. Lay out game lines and logos to comply with rules and diagrams published by National Federation of State High School Association for the sports activities indicated.
- B. Mask flooring at game lines and logos, and apply paint of color indicated to produce clean, sharp and distinct edges.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations after completing resilient athletic flooring installation:
 - 1. Remove marks and blemishes from flooring surfaces.
 - 2. Sweep and then vacuum flooring.
 - 3. Damp-mop flooring to remove soiling.
- B. Protect flooring from abrasions, indentations, and other damage from subsequent operations and placement of equipment, during remainder of construction period.

END OF SECTION

SECTION 09671 -RESINOUS FLOORING

PART I- GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Decorative epoxy-resin flooring (including integral base).

1.2 SUBMITTALS

- A. Acceptance Sample: The acceptance sample shall be a one foot square sample of Tnemec flooring system applied to hardboard or similar backing for rigidity and handling.
- B. Manufacturer's Literature: Descriptive data and specific recommendations for initiating , mixing, application and curing.
- C. Manufacturer's Material Safety Data Sheets (MSDS) for each respective product being used.

1.3 QUALITY ASSURANCE

- A. Acceptance Sample:
 - 1. A minimum one-foot square acceptance sample of the specified flooring system shall be prepared by the manufacturer's representative and submitted to the Owner prior to the bidding phase of the project. All bidders shall inspect the "acceptance sample" before submitting their bids. No contractor shall submit a bid that has not seen this sample.
 - 2. The installed flooring system shall duplicate the acceptance sample in thicknesses of each respective film layer, color, texture and degree of overall appearance and finish.
- B. The finished floor coating shall be uniform in color, texture and appearance. All edges that terminate at walls, floor discontinuities and other embedded items shall be sharp, uniform and cosmetically acceptable with no thick or ragged edge. The Contractor shall work out an acceptable masking technique to ensure the acceptable finish of all edges.
- C. Reference Standards:
 - 1. ACI 308 - Standard Practice for Curing Concrete
 - 2. ACI 302.1R-80-Guide for Concrete Floor and Slab Construction
 - 3. United States Department of Agriculture Acceptance
- D. Contractor Prequalification Requirements:
 - 1. Each bidder for this project shall be a pre-qualified and "Approved Applicator" at the time of bid submittal with 5 years minimum experience.

- 2 Each approved applicator shall have been pre-qualified in all phases of surface preparation and application of the specified floor coating system.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered in original manufacturer's sealed containers with all pertinent labels intact and legible.
- B. Store materials in protected areas at a temperature between 70° F and 90° F.
- C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.5 FIELD CONDITIONS

- A. The material, air and surface temperatures shall be in the range of 60° F to 85° F during application and cure.
- B. The relative humidity in the specific location of the application shall be less than 85% and the surface temperature shall be at least 5° F above the dew point.
- C. The surfaces to be coated shall have been prepared as specified in Section 3.02 "Surface Preparation".
- D. Protect all adjacent surfaces not to be coated with masking and covers.
- E. Do not apply coating materials when dust is being generated.

PART II- PRODUCTS

2.1 RESINOUS FLOORING (RES-1)

- A. Subject to compliance with requirements, provide the following:
 1. Tnemec Epoxy Flooring System.
 2. General Polymers Epoxy Flooring System.
 3. Refer to drawings for Architect's selection.

2.2 MATERIAL PREPARATION

- A. Mix all material in strict accordance with the manufacturer's specific instructions and procedures for the respective material being used.
- B. Pot life and cure times are very short; mix only enough product to satisfy immediate application requirements.

PART III-EXECUTION

3.1 PRE WORK INSPECTION

- A. Examine all surfaces to be coated with these materials and report any conditions that adversely affect the appearance or performance of the coating systems and which cannot be put into acceptable condition by the preparatory work specified in Paragraph 3.02.
- B. Do not proceed with surface preparation and application until the surface is acceptable or authorization to proceed is given by the Architect or Engineer.
- C. Ensure that floor drains, proximate equipment and any other items sensitive to dust and contamination are properly and adequately masked and protected.
- D. For slabs on grade to be treated, Calcium Chloride tests will be run for every 1,000 square feet prior to installation.
- E. Include in the base bid, the installation of Moisture Vapor Mitigation Treatment as recommended by Resinous Flooring Manufacturer. Prior to installation of Moisture Vapor Mitigation Treatment, test for moisture content per method recommended in writing by Resinous Manufacturer. If moisture level is below the manufacturer's maximum allowable, install Resinous flooring without Mitigation Treatment and provide a credit back to the owner. See Project Manual, Section 01270 for Unit Prices. In addition to the contractor testing for slab moisture content the owner reserves the right to engage a third party to test the slab for moisture.

3.2 SURFACE PREPARATION

- A. General:
 - 1. Initially, dislodge dirt, mortar spatter and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming or compressed air blow-down.
 - 2. Surfaces that are heavily contaminated with petroleum or other process products shall be cleaned with the appropriate degreaser, detergent or other effective cleaner/surfactant followed by thoroughly rinsing with fresh water to remove the accumulation prior to mechanical cleaning efforts. Mechanical cleaning will not remove such deposits, but will only drive them deeper.
 - 3. All concrete floor surfaces shall be visibly dry, especially in cracks and other deep surface discontinuities, prior to commencing mechanical cleaning and preparation.
- B. Mechanical Surface Preparation and Cleaning:
 - 1. All accessible concrete floor surfaces shall be mechanically cleaned using a "BlastTrac" method or approved equivalent. All surface and embedded accumulations of paint, toppings, hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be removed leaving a bare concrete surface having a minimum profile of 30 mils and exposing the upper facades on concrete aggregate. (Reference SSPC-SP13 / NACE 6, ICRI CSP 3-5)
 - 2. Floor areas that are inaccessible to the cleaning machine shall be mechanically abraded to the specified degree of cleanliness, soundness and profile using vertical disc scarifiers, starwheel scarifiers, grinders, needle guns or other suitable effective equipment.
 - 3. Cracks in the floor 3/16" and wider, shall be routed out to a minimum 1/2" deep V-groove of sound concrete and filled with materials recommended by the manufacturer. Other

significant surface discontinuities such as holes, pits, depressions and exposed aggregate areas shall be filled with similar materials.

4. Allow the surface to dry or force dry with heat and circulating air to ensure that all surface, especially discontinuities, are visibly dry.
5. All concrete floor terminations and leading edges shall be saw-cut and chiseled down to ¼ to ½" as to avoid feathered edge terminations. This includes drains, construction & expansion joints and all leading edges of concrete floor where they meet dissimilar materials.

3.3 APPLICATION

A. Floor

1. This application shall consist of applying the Primer/Intermediate/Sealer, allowing time for cure, and then applying the topcoats in the sequence and film thicknesses as specified herein below and in Paragraph 3.6 "Coating Schedule".
2. Open only the containers of components to be used in each specific application. Refer to manufacturer's data sheets for pot life/temperature relationship to determine size of batches to mix.
3. Pour the mix onto the floor surface, flat squeegee and backroll to form a uniform, continuous film, ensuring that all crevices, cracks and other surface discontinuities have been saturated and coated.
4. Allow for the Primer/Sealer to cure.
5. Pour intermediate resin onto floor, spread with 40 mil notched squeegee and backroll. Broadcast color quartz to rejection. Allow to cure, sweep and repeat process to achieve approximately 1/8" thick intermediate coat.
6. After full cure, sweep, vacuum and apply topcoat. If a smooth surface is desired, a second topcoat may be necessary.

3.4 INSPECTION

- A. Request acceptance of the Primer/Intermediate coats before application of the Topcoat commences.
- B. All work that is not acceptable to the Architect, Engineer or Owner must be corrected before consideration of final acceptance.

3.5 CLEAN-UP

- A. Remove any material spatters and other material that is not where it should be. Remove masking and covers, taking care not to contaminate surrounding areas.
- B. Repair any damage that should arise from either the application effort or from the clean-up effort.

3.6 COATING SCHEDULE: See Finish Schedule

END OF SECTION 09671

SECTION 09800 - SOUND-ABSORBING WALL UNITS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Shop-fabricated, fabric-wrapped, sound-absorbing wall panel units tested for acoustical performance.
2. Ceiling deck hung banners.

1.2 REFERENCES

- A. ASTM E 84- Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.

1.3 PERFORMANCE REQUIREMENTS

- A. Flame Spread Rating: Provide all components with Class A flame spread rating when tested in accordance with ASTM E 84, unless otherwise specified.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Independent testing agency test reports.

- C. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of experience in producing products of the types specified herein.

- B. Installer Qualifications: Acceptable to the manufacturer of the products being installed.

- C. Mock-Up: Provide a mock-up for evaluation of installed appearance.

1. Install products in areas designated by Architect.
2. Do not proceed with remaining work until Architect approves workmanship and appearance.
3. Approved mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect products from moisture during shipment, storage, and handling.
- B. Store products in manufacturer's unopened packaging until ready for installation.
 1. Store materials flat, in dry, well-ventilated space.
 2. Do not stand panels on end.
 3. Protect edges from damage.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Do not begin installation of acoustical products until building has been enclosed and environmental conditions approximate those that will prevail when building is occupied.
- B. Maintain environmental conditions with temperature limits of 60-80 degrees F (16-27 degrees C) and humidity level not greater than 40%. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 EXTRA MATERIALS

- A. See Section 01600 - Product Requirements, for additional provisions.
- B. Provide 5 percent, but not less than 1 of each type of unit actually installed, for Owner's use in maintenance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Golterman & Sabo; 3555 Scarlet Oak Blvd., St. Louis, MO 63122. ASD. Tel: (636) 225-8800 or (800) 737-0307. Fax: (636) 225-2966. Email: inquiry@golterman.com. www.golterman.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SOUND-DIFFUSING WALL UNITS

- A. G & S Acoustics AP 2 - Acoustic Panels; fiberglass core of 6-7 ppg with chemically hardened edges, with seamless finish material wrapped and bonded to back side of panels.

- 1.NRC: .As indicated on drawings.
- 2.Size: As indicated on Drawings.
- 3.Finish Material: As indicated on Drawings.
- 4.Edges: Square.
- 5.Corners: Square.
- 6.Mounting: Two-part Z-clips.

2.3 ACOUSTIC PANEL ACCESSORIES

- A. Two-part Z clip: Manufacturer's standard mounting bar and matching clips for mounting on rear of acoustical panels.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 09800

SECTION 09911 - EXTERIOR PAINTING

PART I -GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Galvanized metal.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, within the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect

2.3 METAL PRIMERS

- A. Waterborne Galvanized-Metal Primer: As recommended in writing by top coat manufacturer.

2.4 EXTERIOR LATEX PAINTS

- A. Exterior Latex (Semi-Gloss): PPG Speedhide Exterior 100%. Acrylic Latex Semi-Gloss 6-900X1 Series.

PART 3 -EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE

- A. Galvanized-Metal Substrates:
 1. Latex Over Water-Based Primer System:
 - a. Prime Coat: Galvanized-metal primer.
 - b. Intermediate Coat: Exterior acrylic matching topcoat.
 - c. Topcoat: Exterior acrylic (semi-gloss).

END OF SECTION 09911

SECTION 09912 - INTERIOR PAINTING

PART 1-GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete Masonry Units.
 - 2. Steel.
 - 3. Gypsum board.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples: For each finish and for each color and texture required.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 -PRODUCTS

2.1 MANUFACTURERS:

- A. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

- 1. District approved paint manufacturers include: MAB, Sherwin Williams, Benjamin Moore, and Porter (PPG).

- B. Material Compatibility:

- 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction, and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 1. Flat Paints and Coatings: 50 g/L.
- 2. Non-flat Paints and Coatings: 150 g/L.
- 3. Dry-Fog Coatings: 400 g/L.
- 4. Primers, Sealers, and Undercoaters: 200 g/L.
- 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
- 7. Pretreatment Wash Primers: 420 g/L.
- 8. Floor Coatings: 100 g/L.

- D. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

- 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.

- d. Benzene.
- e. Butyl benzyl phthalate.
- f. Cadmium.
- g. Di (2-ethylhexyl) phthalate.
- h. Di-n-butyl phthalate.
- i. Di-n-octyl phthalate.
- J. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

E. Colors: See Drawings for Finish Schedule.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior: MPI#4
 - 1. Sherwin Williams Loxon A24W00200

2.4 PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer: MPI #50.
 - 1. PPG Speedhide Interior Latex Primer Sealer 6-2.
- B. Interior Alkyd Primer/Sealer: MPI #76
 - 1. PPG Multi-prime Fast Dry 94-258/269.
- C. Interior Alkali Resistant Primer/Sealer: MPI #3
 - 1. PPG Perma-Crete Alkali Primer 4-603.

2.5 METAL PRIMERS

- A. Alkyd Anticorrosive Metal Primer: MPI#79
 - 1. PPG Speedhide Interior/Exterior Rust Inhibitive Steel Primers 6-212.

2.6 LATEX PAINTS

- A. Interior Latex (Satin): MPI #44
 - 1. PPG Speed.hide Interior Enamel Eggshell Latex 6-411.
- B. Interior Latex (Semi-gloss): MPI #54
 - 1. PPG Speed.hide Interior Semi-Gloss Acrylic Latex 6-500.
- C. Interior Latex (Flat): MPI #53
 - 1. PPG Speed.hide Interior Ceiling Flat Latex 6-70.

2.7 SOLVENT BASED PAINTS

- A. Alkyd, Interior, Semi-Gloss (Gloss Level 5): MPI #47
- B. Alkyd, Interior, Gloss (Gloss Level 6): MPI #48
- C. Alkyd, Quick Dry, Semi-Gloss (Gloss Level 5): MPI# 81
- D. Alkyd, Quick Dry, Gloss (Gloss Level 7): MPI #96

2.8 DRY FOG/FALL COATINGS

- A. Dry Fall, Water Based for Steel, Flat MPI #133.
 - 1. PPG Speedhide SuperTech WB Acrylic Dry-Fog 6-725.
- B. Dry Fall, Alkyd, Flat MPI #55.
 - 1. PPG Speedhide SuperTech Alkyd Dry-Fog Enamel 6-150.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Masonry (Clay and CMU): 12 percent.
 - 2. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Electrical Work:
 - a. Switchgear.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Latex System.
 - a. Prime Coat: Heavy duty block filler.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex. See finish Schedule

B. Steel Substrates:

1. Alkyd System:

- a. Prime Coat: Primer, Alkyd, anti-corrosive, for metal
- b. Intermediate Coat: Alkyd, Interior, matching topcoat.
- c. Topcoat: Alkyd, Interior, Semi-Gloss, Exterior, Gloss.

2. Water-Based Dry-Fall System:

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Topcoat: Latex dry fog/fall (satin).

C. Gypsum Board Substrates:

1. Latex System:

- a. Prime Coat: Interior latex primer/sealer.
- b. Intermediate Coat: Interior latex matching topcoat.
- c. Topcoat: Interior latex (flat) and (satin). See finish schedule.

END OF SECTION 09912

SECTION 09960 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of 2 component, high-performance coating systems on the following substrates:
 - 1. Interior Substrates:
 - a. Concrete Masonry Units and Precast Concrete, vertical surfaces.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples: For each type of coating system and in each color and gloss of topcoat indicated.
- C. Product List: For each product indicated, include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Wall Surfaces: Apply samples on at least 100 sq. ft. (9 sq. m) of wall surface.

1.5 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C)
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 1. Allow wet surfaces to dry thoroughly before proceeding with or continuing coating operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- C. Colors: See Finish Schedule.

2.3 EPOXY COATINGS

- A. Epoxy, Semi-Gloss:
 1. PITT-GLAZE WB1, Waterborne by PPG for walls and ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 4 percent.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE (EPOXY SYSTEMS)

A. Concrete Masonry Units and Precast Concrete, Vertical Surfaces.

- a. First Coat: Block Filler
- b. Second Coat: Primer formulated for moderate environment
- c. Third Coat: Intermediate coat.
- d. Topcoat: Moderate-environment, semi-gloss epoxy.

B. Dry Wall Ceiling.

- a. First Coat: Primer formulated for moderate environment
- b. Second Coat: Intermediate coat.
- c. Topcoat: Moderate environment, satin epoxy.

END OF SECTION 09960

SECTION 10101 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Markerboards.
 - 2. Tackboards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of panel joints.
 - 2. Include sections of typical trim members.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Qualification Data: For qualified Installer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
- F. Maintenance Data: For visual display surfaces to include in maintenance manuals.
- G. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

1.4 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Claridge Products and Equipment, Inc.
 - b. PolyVision Corporation; a Steelcase company.
- B. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
- C. Hardboard: ANSI A135.4, tempered.
- D. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
- E. Fiberboard: ASTM C 208.
- F. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- G. Adhesives: Manufacturer's standard product.

2.2 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Claridge Products and Equipment, Inc.
2. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 TACKBOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Claridge Products and Equipment, Inc.
- B. Fabric Covered Cork Tackboard: 1/4-inch- (6-mm-) thick, fabric covered cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard backing.

2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape of size and shape indicated on Drawings.
 1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
- B. Map Rail: Provide the following accessories:
 1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
 2. End Stops: Located at each end of map rail.
 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1219 mm) of map rail or fraction thereof.

2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as indicated on approved Shop Drawings.
 2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
 3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
 4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.7 VISUAL DISPLAY SURFACE SCHEDULE

- A. Visual Display Board: Factory assembled.

1. Markerboard: Porcelain-enamel markerboard assembly.
 - a. Color: White.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Field-Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
8. Accessories:
 - a. Map rail with display rail, end stops, map hooks and clips.

- B. Tackboard: Factory assembled.

1. Tack Surface: Fabric covered-cork tackboard assembly.
 - a. Color: As indicated on Drawings.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Edges: Concealed by trim.

- a. Field-Applied Aluminum Trim: Manufacturer's standard style, with clear anodic finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
- B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
 1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.
- D. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION 10101

SECTION 10170 – SOLID COLOR REINFORCED COMPOSITE TOILET PARTITIONS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - a. Toilet Compartments
 - b. Urinal Screens

1.2 RELATED SECTIONS

- A. Division 6 Section “Miscellaneous Carpentry” for wall backing required to secure mounting brackets.
- B. Division 10 Section “Toilet Accessories” for toilet room accessories.

1.3 REFERENCES (INCLUDING, BUT NOT LIMITED TO)

- A. National Fire Protection Association 101 Life Safety Code 2006 Edition, Chapter 10.
- B. ANSI A117.1-1998 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- C. International Building Code (IBC), 2006 Edition, Chapters 8, 11, and 12.
- D. International Plumbing Code (IPC), 2006 Edition, Chapter 3, Section 10.
- E. Title 24, California Code of Regulations, Parts 2, 3, and 5.
- F. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.
- G. Fair Housing Amendments Act of 1988, Accessibility Guidelines, Federal Register Volume 56, Number 44.
- H. US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Program, Version 2.1
- I. American Society for Testing and Materials Standards:
 - 1. ASTM E84-01 Standard Test Method for Surface Burning Characteristics of Building Material.
 - 2. ASTM D2794-93 (1999)e1 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

3. ASTM D2197-98 (2002) Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
4. ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance.

1.4 PERFORMANCE REQUIREMENTS

- A. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":
 1. Cleanability: Five (5) required staining agents shall be cleaned off material.
- B. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98(2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:
 1. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.
- C. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93 (1999)e1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
 1. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
- D. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
 1. Smoke Developed Index: Not to exceed 450.
 2. Flame Spread Index: Not to exceed 75.
 3. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA): Class B.
 - b. International Code Council (ICC): Class B.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of product indicated. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Maintenance Data.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver items in manufacturer's original unopened protective packaging.
- B. Store materials in original protective packaging to prevent physical damage or wetting.
- C. Handle so as to prevent damage to furnished surfaces.

1.7 WARRANTY

- A. Furnish ten-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.
- B. Furnish one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Bobrick Washroom Equipments, Inc.
- B. Toilet partitions shall be the product(s) of a single manufacturer.

2.2 MOUNTING CONFIGURATIONS

- A. Toilet Partitions shall be:
 - 1. Overhead-Braced (Bobrick 1092.67 SierraSeries)
- B. Urinal Screens shall be:
 - 1. Floor to Ceiling (Bobrick 1096.67 SierraSeries)

2.3 COMPONENTS / MATERIALS

- A. Stiles, Panels, Doors, and Screens shall all be manufactured from Solid Color Reinforced Composite material.
- B. Toilet Partition Material

1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate / phenolic resins. Material shall have a non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.
2. Toilet partitions constructed of High Density Polyethylene (HDPE) or High Density Polypropylene will not be acceptable.

C. Finish Thickness

1. Stiles and doors shall be $\frac{3}{4}$ " (19mm).
2. Panels and benches shall be $\frac{1}{2}$ " (13mm).

D. Hardware

1. All hardware to be 18-8, type-304 stainless steel with satin finish.
2. Hardware of chrome-plated "Zamak", aluminum, or extruded plastic is unacceptable.

E. Latch

1. Sliding door latch shall be 14-gauge (2mm) and shall slide on nylon track.
2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
3. Latch track shall be attached to door by machine screws into factory installed threaded brass inserts.
4. Threaded brass inserts shall be factory installed for door hinges and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
5. Through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners shall be used at latch keeper-to-stile connections and shall withstand direct full force exceeding 1,500 lbs. per fastener.

F. Hinges

1. Hinge shall be 16-gauge (1.6mm) continuous piano hinge.
2. All doors shall be equipped with self-closing hinge.
3. Continuous piano-hinge shall be attached to door and stile by theft-resistant, pin-in-head Torx stainless steel machine screws into factory installed, threaded brass inserts.
4. Fasteners secured directly into the core are not acceptable.
5. Door shall be furnished with two 11-gauge (3mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.
6. Door stops and hinges shall be secured with stainless steel, pin-in-head Torx machine screws into threaded brass inserts.
7. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.

G. Clothes Hook

1. Clothes Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29 mm) from face of door.
2. Clothes hook shall be secured to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Through bolted fasteners shall withstand a direct pull force exceeding 1,500 lbs per fastener.

- H. Mounting Brackets
 - 1. Mounting brackets shall be 18-gauge (1.2mm) stainless steel and extend full height of panel.
 - 2. U-channels shall be furnished to secure panels to stiles.
 - 3. Angle brackets shall be furnished to secure stiles-to-walls and panels-to-walls.
 - 4. Fasteners at locations connecting panels-to-stiles shall utilize through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.
 - 5. Wall mounted urinal screen brackets shall be 11 gauge (3mm) double thickness.
- I. Leveling Device shall be 7-gauge, 3/16" (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.
- J. Stile Shoe shall be one-piece, 4" (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Top shall have 90° return to stile. Shoe will be composed of one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.
- K. Headrail (Overhead-Braced) shall be satin-finish, extruded anodized aluminum (.125"/3mm thick) with anti-grip profile.

2.4 FABRICATION

- A. Vandal-Resistant Hardware Option: for Institutional Hardware option add suffix .67 to 1092 Series.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Check areas scheduled to receive compartments for correct dimensions, plumbness or walls, and soundness of surfaces that would affect installation of mounting brackets.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- C. Do not begin installation of compartments until conditions are satisfactory.

3.2 ERECTION

- A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.
- B. Installation methods shall conform to manufacturer's recommendation for backing and proper support.
- C. Conceal evidence of drilling, cutting, and fitting to room finish.

D. Maintain uniform clearance at vertical edge of doors.

3.3 ADJUSTMENT AND CLEANING

A. Adjust hardware for proper operation after installation.

B. Set hinge cam on inswinging doors to hold doors open when unlatched.

C. Set hinge cam on outswinging doors to hold unlatched doors in closed position.

D. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 10170

SECTION 10265 - IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Corner guards.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each impact-resistant wall production unit. Include sections, details, and attachments to other work.
- C. Samples: For each type of unit and for each color and texture required.
- D. Maintenance data.
- E. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration of plastic and materials beyond normal use.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Extruded Rigid PETG: High-impact-resistant PETG with shadow grain texture and integral color throughout, nominal .078" (1.98mm) thickness. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer, colors to be indicated in the finish schedule from one of manufacturer's standard color range.
- B. Aluminum Extrusions: ASTM B 221.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive metal; security-type where exposed to view.

2.2 CORNER GUARDS

- A. Surface-Mounted, Resilient, PETG Corner Guards: Assembly consisting of snap on plastic cover, installed over continuous retainer including mounting hardware; fabricated with 90 degree turn to match wall condition;
 - 1. Available manufacturers or approved equal:
 - a. Construction Specialties, Inc.; Product: SSM-20AN.
 - 2. Cover: Extruded rigid PETG, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Color and Texture: As indicated on Drawings.
 - 3. Retainer: Minimum 0.070-inch- thick, one piece, extruded aluminum.
 - 4. Aluminum Cove Base: None.
 - 5. Height: As indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.
- B. Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Adjust end, bottom and top caps as required to ensure tight seams.

- C. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- D. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10265

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Recessed and semi-recessed fire-protection cabinets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.
- B. Samples: For each exposed cabinet finish.
- C. Maintenance data.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.
- C. Coordinate locations/block-outs in precast wall panels.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

2.2 PORTABLE FIRE EXTINGUISHERS

- A. Available Manufacturer or approved equal:
 1. Larsen's Manufacturing Company.
- B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.
 1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 FIRE-PROTECTION CABINET

- A. Available Manufacturer or approved equal:
 1. Larsen's Manufacturing Company.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Construction: Nonrated.
- D. Cabinet Material and Shelf: Enameled-steel sheet.
- E. Recessed and semi-Recessed Cabinets: Cabinet box recessed or semi-recessed in walls (see details) of sufficient depth to suit style of trim indicated.
 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend) of 1/4 to 5/16 inch.
- F. Cabinet Trim Material: Steel sheet.

- G. Door Material: Steel sheet.
- H. Door Style: Flush opaque panel, frameless, with no exposed hinges.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER ."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim, except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.
- C. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.
- D. Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- E. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- F. Identification: Apply vinyl lettering at locations indicated.
- G. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- H. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair.

END OF SECTION 10520

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Toilet and bath accessories.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and product designations indicated on Drawings.
- C. Warranty: Sample of special warranty.
- D. Maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. World Dryer Corporation.
 - 3. ASI, American Specialties, Inc.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19, ASTM B 16, or ASTM B 30 castings.
- C. Steel Sheet: ASTM A 366/A 366M, 0.0359-inch minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
- I. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.3 TOILET AND BATH ACCESSORIES

- A. See list of Toilet Accessories on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturer's written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 10801

SECTION 11490 – GYMNASIUM EQUIPMENT

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary conditions and division1 specification sections, apply to this section.

1.2 SUMMARY

- A. This section includes the following gymnasium equipment:
 - 1. Basketball Equipment
 - 2. Wall-Mounted Safety Pads
 - 3. Volley Ball Equipment Sleeves

1.3 DEFINITIONS

- A. FIBA: International Basketball Federation (Federation Internationale de Basketball Amateur)
- B. NAGWS: National Association for Girls and Women in Sport
- C. NCAA: National Collegiate Athletic Association
- D. NFHS: National Federation of State High School Associations

1.4 SUBMITTALS

- A. Product data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, features, and finishes. Include details of anchors, hardware, and fastenings. If applicable, include assembly, disassembly, and storage instructions.
 - 1. Gymnasium Equipment Operators: Include operating instructions
- B. Shop Drawings: Show location and extent of fully assembled gymnasium equipment. Show location and extent of disassembled equipment and components and transport and storage accessories. Include elevations, sections, and details not shown in product data. Show method of field assembly, connections, installation details, mountings, floor inserts, attachments to other work, operational clearances, and relationship to adjoining work.
 - 1. Blocking and reinforcement: Show locations of blocking and reinforcement required for support of gymnasium equipment.

- C. Coordination Drawings: Court layout plans and elevations drawn to scale and coordinating floor-insert penetrations and game lines and markers applied to finish floor.
- D. Samples for initial selection: For each type of gymnasium equipment indicated where feasible.
- E. Samples for verification: For the following products
 - 1. Pad fabric: complete line of manufacturer's colors with material specifications included.
 - 2. Curtain fabric: complete line of manufacturer's colors with material specifications included.
- F. Product certificates: For each type of gymnasium equipment, signed by product manufacturer.
- G. Manufacturers certificates: Signed by manufacturers certifying that they comply with requirements. Include evidence of manufacturing experience.
- H. Qualification data: For professional engineer
- I. Maintenance Data: For gymnasium equipment and gymnasium equipment operator to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer
- B. Source limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
- C. Standards: Provide gymnasium equipment complying with or exceeding the requirements of the Missouri State High School Association

1.6 PROJECT CONDITIONS

- A. Environmental limitations: Don not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for it's intended use.
- B. Field measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment. Verify dimensions by field measurements.

1.7 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and markers on finished floor.
- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction that penetrates ceilings or is supported by them,

including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

1. Basketball Equipment
 - a. Aalco Mfg. Co.
2. Wall-Mounted Safety Pads
 - a. Aalco Mfg. Co.
3. Volleyball Equipment Sleeves
 - a. Aalco Mfg. Co.

2.2 MATERIALS, GENERAL

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; mill finish or decorative, baked-enamel, powder- coat finish.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221
2. Cast Aluminum: ASTM B 179

B. Steel: Comply with the following

1. Steel plates, shapes, and bars: ASTM A 36/A 36M, hot dipped galvanized
2. Steel pipe: Standard-weight steel pipe complying with ASTM A 53.
3. Cold formed Steel tubing: ASTM A 500, Grade A, unless another grade is required by structural loads.
4. Steel mechanical tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 569/A 569 M and complying with the dimensional tolerances in ASTM A 500.
5. Malleable- iron castings: ASTM A 47, Grade required by structural loads.
6. Support cable: ¼ inch- (6mm) diameter, 7x19 galvanized steel aircraft cable with a manufacturer's written recommendation for size, number, and method of installation.
7. Support chain: Proof coil chain, complying with ASTM A 413/A 413M, grade 30, size and diameter as required by structural loads; plated or painted. Provide fittings complying with chain manufacturers written recommendations for size, number, and method of installation.

C. Particleboard: ANSI A208.1.

- D. Wood-based, Structural-use panels: Comply with DOC PS 2; for plywood, comply with DOC PS 1.
- E. Equipment mounting pads: Wood, transparent or neutral color painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written recommendations
- F. Anchors, fasteners, fittings, and hardware: Manufacturer's standard corrosion resistant or non-corrodible units. Provide as required for gymnasium equipment assembly, mounting, and secure attachment.
- G. Non-shrink, non-metallic grout: Premixed, factory- packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

2.3 BASKETBALL EQUIPMENT

- A. Specifications herewith are based upon products produced by Aalco Manufacturing Company, St. Louis, MO 63125.
 - 1. Provide Aalco Mfg. Co. model #2000FS (Rear-Braced Forward Swing Up)
 - a. Backboard supporting main drop shall be in the form of a braced "T" of welded construction where size will permit it to be so shipped. Braces shall be of at least 2 3/8" O.D. pipe and stem shall be 6 5/8" O.D. 11 ga. steel tube. Bracing shall extend to within 24" of top of backboard to assure adequate torsional support of the backboard. Backboard shall be extended at least 6 inches out from the drop by rigid support brackets. An adequate-sized brace (at least 2-3/8" O.D.-9 ga) inclined approx. 30 deg. from the vertical stem, shall support the stem to the rear of the backboard and telescope to permit raising of the structure to a horizontal storage position. A stop collar shall terminate lowering of backstop at play position, and wedge-lock engage the I.D. of the outside brace tube until withdrawn by operation of the winch.
 - b. Folding operation of the backstop shall be provided by electric winch model #75RC. Operator shall include the following features: 1) 120 VAC, capacitor-start, overload-protected motor of such HP as to raise the backstop in 2 minutes or less; 2) worm-gear speed reduction for unassisted support of load at all times, including the event of a power failure; 3) lubed-for-life bearings and gearing; 4) hoist-mounted, pre-wired rotary travel control mechanism, easily set to automatically limit both up & down travel; 5) reversing magnetic contactor enabling 4-wire remote control of hoist; and 6) up-off-down, momentary-contact, flush mounting control switch to be mounted in a remote location, key-operated to prevent unauthorized operation.
 - c. The model #AST (Safe-Tether) shall be a completely automatic, non-electric mechanism capable of catching and holding a basketball backstop at any time & at any position of "folding" should it fall due to a failure in the hoist system. The catch shall mount to an independent portion of the overhead structure and attach to the folding structure of the backstop by means of a tether which wind/rewinds from a spring-powered storage reel. The tether shall be of 2" wide, 6000 lb. tensile, nylon webbing to provide both high strength & maximum shock cushioning. Rewind power shall be provided by a "spring-motor" design spring in order to provide a uniform 8 lb. torque essential to avoiding

slack. "Spirator" & other spring designs whose force diminishes 50% over its cycle will not be acceptable. A flyweight mechanism of the catch shall provide response to high speed unwinding of the tether strap by tripping the engagement of a ratchet catch, so as to stop the load within 12" of travel. A simple lever shall allow easy re-setting of a "tripped" catch. The catch shall be of such rugged construction as to be impervious to the impact of basketball, etc.

- d. Backboard shall be Aalco Mfg. Co. model #501SUB. Shall be of official 72" x 42" size and incorporate ½" tempered plate glass with fired in white target and border framed in 6063-T6 extruded aluminum equipped with key-slotted steel corner brackets. Goal shall mount directly to a steel box-beam running the entire lower edge of the board. Rubber gasketing shall separate all glass and metal parts. Backboard shall be provided guaranteed for life against breakage of the glass.
 - e. Goal shall be Aalco Mfg. Co. model #28HS4. Goal shall be of 5/8" round cold rolled material formed to an exact 18" inside diameter. Goal shall provide a safe-release mechanism designed to flex downward when pre-set pressure is applied to the rim without sustaining a permanent bend. Goal shall be provided with a 12 loop nylon net and finished in electrostatic powder coated orange.
 - f. Backboard shall be provided with Aalco Mfg. Co. model #RBP-PG bolt- on type safety padding and shall be black as chosen by the architect from manufacturer's standard color selection sheet.
 - g. Height adjustment feature shall be Aalco Mfg. Co. model #2000 So-Lo glide. Unit shall be of electric operation and shall allow adjustment of the goal height from 8' to 10' above playing surface. Unit shall be of internal telescoping type allowing the force of play to be diverted to the mast and superstructure assembly and not to the feature itself. Bolt-on type height adjusters shall not be considered equal.
2. Provide Aalco Mfg. Co. model #20SWV (Stationary Wall-Mounted VEE)
- a. Backboard shall be attached to an internal So-Lo Glide electric height adjuster mechanism which shall be fixed to a VEE design incorporating 2" schedule 40 pipe assembled to bolt to the 6 5/8" O.D. main tube.
 - b. Backboard shall be Aalco Mfg. Co. model #501SUB. Shall be of official 72" x 42" size and incorporate ½" tempered plate glass with fired in white target and border framed in 6063-T6 extruded aluminum equipped with key-slotted steel corner brackets. Goal shall mount directly to a steel box-beam running the entire lower edge of the board. Rubber gasketing shall separate all glass and metal parts. Backboard shall be provided guaranteed for life against breakage of the glass.
 - c. Goal shall be Aalco Mfg. Co. model #28HS4. Goal shall be of 5/8" round cold rolled material formed to an exact 18" inside diameter. Goal shall provide a safe-release mechanism designed to flex downward when pre-set pressure is applied to the rim without sustaining a permanent bend. Goal shall be provided with a 12 loop nylon net and finished in electrostatic powder coated orange.

- d. Backboard shall be provided with Aalco Mfg. Co. model #RBP-PG bolt- on type safety padding and shall be red as chosen by the architect from manufacturer's standard color selection sheet.
- e. Height adjustment feature shall be Aalco Mfg. Co. model #2000 So-Lo glide. Unit shall be of electric operation and shall allow adjustment of the goal height from 8' to 10' above playing surface. Unit shall be of internal telescoping type allowing the force of play to be diverted to the mast and superstructure assembly and not to the feature itself. Bolt-on type height adjusters shall not be considered equal.

2.4 WALL MOUNTED SAFETY PADS

- A. Specifications herewith are based upon products produced by Aalco Manufacturing Company, St. Louis, MO 63125.
 - 1. Provide Aalco Mfg. Co. model #SWP, safety wall padding as indicated on drawings.
 - a. Wall pads shall be Aalco Mfg. Co. model #SWP. Pads shall be of 2' x 6' construction of 2" thick foam bonded to 7/16" O.S.B. Pad shall be permanently mounted by means of 1" nailer lips at top and bottom and shall be covered in 13oz. polyester reinforced fire retardant vinyl of color chosen by the architect from manufacturer's full range of colors.

END OF SECTION 11490

SECTION 12494 - ROLLER SHADES

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Provide electrically and manually operated roller shades.
 - 1. Include local, group and master motor control systems for shade operation with quiet, addressable, encoded motors.

1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for blocking, installation of shade pockets, closures and related accessories.
- B. Section 09510 - Acoustical Ceilings: Coordination with acoustical ceiling systems for blocking, installation of shade pockets, closures and related accessories.
- C. Division 16 - Electrical: Electric service for motors, motor controls, internal communication, low voltage wiring and data transfer, and connection to Internet.

1.3 SUBMITTALS

- A. Information Required with Submittal of Bid: In order to evaluate proposals for motorized roller shade control systems, the Architect requires the following information be submitted prior to the award of the roller shade system.
 - 1. Bid proposal shall be accompanied with a document that notes all deviations from these specifications on a line-by-line basis.
 - 2. Bid shall include separate line items listing the control/interface components required for building automation systems and building management systems (BAS/BMS), daylighting, audiovisual, and/or central integration systems. Roller shade controls manufacturer shall list all components included in their bid and shall include a letter stating that they shall be financially responsible for any change orders and/or back charges required by the BAS/BMS, audiovisual, or lighting control systems contractors to interface with the motorized roller shade system.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
 - 5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, power and control wiring diagrams, and relationship to adjacent work.
 - 1. Prepare shop drawings on AutoCAD or Microstation format using base sheets provided electronically by the Architect.

2. Prepare control wiring diagrams based on zones, switching and operational requirements provided by the Architect in electronic format.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
 - E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
 - F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
 - G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
 - H. Solar and Sky Monitoring Systems: Functionality of the solar monitoring and sky monitoring systems. Provide non-proprietary detailed description of the science and logic employed in the bidders automated solar ray tracking control system and a schedule of the solar data provided

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.
- B. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.
- G. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
- H. Requirements for Roller Shade Installer/Contractor:
 1. Roller Shade Hardware, shade fabric, motor, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

2. Roller Shade Installer/Contractor shall list all components and systems included in their bid, including but not limited to, the prime manufacturer of the motor control and automated equipment and shall be financially responsible for any change orders and/or back charges required by the BMS, AV, or Lighting Control Systems contractors to interface with the automatic solar tracking system and the motorized roller shade system.

- I. Mock-Up: Provide a mock-up, if Architect requires, of one roller shade assembly for evaluation of mounting, appearance and accessories.
 1. Locate mock-up in window designated by Architect.
 2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

- A. Motorized Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.
- C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed owners responsibility.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer for Roller Shade Systems and Controls: MechoShade Systems, Inc.; 42-03 35th Street, Long Island City, NY 11101. Tel: (718) 729-2020 ext 1901; Mr. Glen Berman. Email: glenb@mechoshade.com.
 - B. TMI is acceptable subject to compliance with requirements.
- #### 2.2 SCHEDULE

- A. Roller Shade Schedule: Refer to the Drawings for locations.
 1. Shade Type WT-1: Motorized interior solar roller shades in all exterior / interior windows of rooms and spaces as shown on referenced Drawings, and related motor control requirements systems. Include the following as scheduled and as indicated on the Drawings:
 - a. Fascias.

2.3 INTELLIGENT ENCODED SHADE MOTOR DRIVE SYSTEM

- A. Shade Motors:
1. Quiet [44 – 46 db] Intelligent Encoded Motor and Control System: Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), (230v/50 hz AC) single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
 2. Conceal motors inside shade roller tube.
 3. Maximum current draw for each shade motor of 2.3 amps @ 110 V (.9 amps @230 V AC).
 4. Use motors rated at the same nominal speed for all shades in the same room.
- B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly. Spring assisted lift systems shall not be accepted.
- C. Quiet Intelligent Encoded Motor System (software, two-way communication): Specifications and design are based on the Intelligent Motor Control System / WhisperShade-IQ™ Motor System) as manufactured by MechoShade Systems, Inc. Other systems may be acceptable providing all of the following performance capabilities are provided. Motor control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
1. Quiet operation of up to 46dBA within 3' feet, open air.
 2. Upper and lower stopping points (operating limits) of shade bands shall be programmed into motors via a hand held removable program module / configurator.
 3. Intermediate stopping positions for shades shall allow for up to three (3) repeatable and precise aligned positions.
 4. Up to 103 available alignment points including 3-user programmable predefined intermediate positions, for a total of 5-defined and aligned positions. All shades on the same switch circuit with the same opening height shall align at each intermediate stopping position.
 5. Two inherent methods of control:
 - a. Cost effective, low voltage, hardwired dry-contact for local switch or 3rd party control operation.
 6. Uniform or Regular Modes of Operation:
 - a. Uniform mode shall allow for shades to only move to intermediate stop positions.
 - b. Regular mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.
 7. Wall Switches:
 - a. IQ-Switch: in 5 or 10 button, single gang, low voltage.

2.4 SHADE BAND

- A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets shall not be acceptable.
1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
 - a. Hembar shall be heat sealed on all sides.
 - b. Open ends shall not be accepted.

2. Shade band and Shade Roller Attachment:
 - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
 - b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" Spline mounting, without having to remove shade roller from shade brackets.
 - c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
 - d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

2.5 SHADE FABRICATION

- A. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
 1. Concealed hemtube.
- B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- C. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.
- D. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.
- E. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
 1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

2.6 COMPONENTS

- A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.

B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).
4. All bands within a single motor group shall be aligned within 1/4 inch.

C. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
6. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
7. Drive Bracket / Brake Assembly:

- a. Drive Bracket shall be fully integrated with all accessories, including, but not limited to: fascia, center supports and connectors for multi-banded shades.
 - b. Drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
 - c. The brake shall be an over - running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
 - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
 - e. The entire assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
- D. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.7 SHADE CLOTH

- A. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.
- 1. Dense "3000 Satin Texture series" visually translucent, twill-weave pattern at 2 percent open.
 - 2. Color: Selected from manufacturer's standard colors.

2.8 ACCESSORIES

- A. Fascia:
- 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 - 2. Fascia shall be able to be installed across two or more shade bands in one piece.
 - 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 - 4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Test electrically operated shades for proper operation. Repair or replace units, which do not perform correctly.
- E. Test automated tracking control system for proper operation. Repair or replace units, which do not perform correctly.
- F. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 13930 - WET-PIPE FIRE-SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipes, fittings, and specialties.
 2. Fire-protection valves.
 3. Fire-department connections.
 4. Sprinklers.
 5. Alarm devices.
 6. Pressure gages.

1.2 SYSTEM DESCRIPTIONS

- A. New building sprinkler system to be installed to serve new additions, renovated and existing building. Sprinkler system provider shall provide a design/build system to comply with all applicable codes and standards. Existing building contains wood ceiling in existing gym space. Contractor to provide sprinklers for new plenum as required.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. The fire sprinkler contractor shall perform flow test at the site to determine available water supply.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Libraries except Stack Areas: Light Hazard.
 - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - f. Office and Public Areas: Light Hazard.
 - g. Classrooms: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For qualified Installer and professional engineer.
- E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- F. Welding certificates.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.
- I. Operation and maintenance data.
- J. Layout Drawings: Submit layout drawings for Architect's review and approval prior to performing hydraulic calculations, sizing pipes or submitting to Authorities Having Jurisdiction. Layout drawings shall show location and type of all heads, location and elevation of all piping and locations of other devices and equipment including but not limited to fire

department connections, backflow preventers, meters, post indicating valves, detector checks, vaults etc.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 PIPE AND FITTINGS

A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Thinwall Black-Steel Pipe: ASTM A 135, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

C. Black Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable- or Ductile-Iron Unions: UL 860.

E. Cast-Iron Flanges: ASME 16.1, Class 125.

- F. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- G. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- H. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Corcoran Piping System Co.
 - c. National Fittings, Inc.
 - d. Shurjoint Piping Products.
 - e. Tyco Fire & Building Products LP.
 - f. Victaulic Company.
 - 2. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating: 175 psig (1200 kPa).
- B. Check Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AFAC Inc.

- b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
- c. Anvil International, Inc.
- d. Clow Valve Company; a division of McWane, Inc.
- e. Fire-End & Croker Corporation.
- f. Fire Protection Products, Inc.
- g. Metraflex, Inc.
- h. Milwaukee Valve Company.
- i. Mueller Co.; Water Products Division.
- j. NIBCO INC.
- k. Potter Roemer.
- l. Tyco Fire & Building Products LP.
- m. Victaulic Company.
- n. Viking Corporation.
- o. Watts Water Technologies, Inc.

- 3. Standard: UL 312.
- 4. Pressure Rating: 250 psig (1725 kPa) minimum.
- 5. Type: Swing check.
- 6. Body Material: Cast iron.
- 7. End Connections: Flanged or grooved.

C. Indicating-Type Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Shurjoint Piping Products.
 - h. Tyco Fire & Building Products LP.
 - i. Victaulic Company.
- 3. Standard: UL 1091.
- 4. Pressure Rating: 175 psig (1200 kPa) minimum.
- 5. Valves NPS 2 (DN 50) and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
- 6. Valves NPS 2-1/2 (DN 65) and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.

7. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch visual indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Barnett.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Fire-End & Croker Corporation.
 - e. Fire Protection Products, Inc.
 - f. Kennedy Valve; a division of McWane, Inc.
 - g. Metso Automation USA Inc.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Potter Roemer.
 - k. Tyco Fire & Building Products LP.
 - l. Victaulic Company.
 - m. Watts Water Technologies, Inc.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4 (DN 20).
6. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AFAC Inc.
 - b. Elkhart Brass Mfg. Company, Inc.
 - c. GMR International Equipment Corporation.
 - d. Guardian Fire Equipment, Inc.
 - e. Potter Roemer.
3. Standard: UL 405.
4. Type: Flush, for wall mounting.
5. Pressure Rating: 175 psig (1200 kPa) minimum.
6. Body Material: Corrosion-resistant metal.
7. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
8. Caps: Brass, lugged type, with gasket and chain.
9. Escutcheon Plate: Rectangular, brass, wall type.
10. Outlet: With pipe threads.
11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to " AUTO SPKR."
14. Finish: Polished chrome plated.
15. Outlet Size: NPS 4 (DN 100).

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Triple R Specialty.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.9 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFAC Inc.
 - 2. Globe Fire Sprinkler Corporation.
 - 3. Reliable Automatic Sprinkler Co., Inc.
 - 4. Tyco Fire & Building Products LP.
 - 5. Venus Fire Protection Ltd.
 - 6. Victaulic Company.
 - 7. Viking Corporation.

- B. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

- C. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Nonresidential Applications: UL 199.
 - 2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

- D. Sprinkler Finishes:
 - 1. White polyester recessed.
 - 2. White painted concealed.
 - 3. Bronze.

- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Recessed white polyester, steel, one piece, flat for sprinklers in acoustical ceilings.
 - 2. Ceiling Mounting: Concealed with white cover plate in drywall ceilings.

2.10 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.

- B. Water-Flow Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ADT Security Services, Inc.

- b. McDonnell & Miller; ITT Industries.
- c. Potter Electric Signal Company.
- d. System Sensor; a Honeywell company.
- e. Viking Corporation.
- f. Watts Industries (Canada) Inc.

- 2. Standard: UL 346.
- 3. Water-Flow Detector: Electrically supervised.
- 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- 5. Type: Paddle operated.
- 6. Pressure Rating: 250 psig (1725 kPa).
- 7. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
- 2. Standard: UL 346.
- 3. Type: Electrically supervised.
- 4. Components: Single-pole, double-throw switch with normally closed contacts.
- 5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMETEK; U.S. Gauge Division.
 - 2. Ashcroft, Inc.
 - 3. Brecco Corporation.
 - 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
- D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

- F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 2 Section "Facility Fire-Suppression Water-Service Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 15 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 15 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 15 Section "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- E. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels. A 3" tolerance is acceptable.

3.6 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.9 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Wet-pipe sprinkler system, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Thinwall black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
5. Thinwall black-steel pipe with plain ends; welding fittings; and welded joints.

3.10 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate unless otherwise noted.
 2. Upright and Pendent Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION 13930

SECTION 14240 - MACHINE ROOM-LESS HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Machine room-less hydraulic passenger elevators as shown and specified.

Elevator work includes:

1. Standard pre-engineered hydraulic passenger elevators.
2. Elevator car enclosures, hoistway entrances and signal equipment.
3. Operation and control systems.
4. Jack(s).
5. Accessibility provisions for physically disabled persons.
6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
7. Materials and accessories as required to complete the elevator installation.

- B. Related Sections:

1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
4. Division 5 Metals:
 - a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
 - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
6. Division 16 Sections:
 - a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
 - b. Emergency power supply, transfer switch and auxiliary contacts.
 - c. Heat and smoke sensing devices.
 - d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.
7. Division 22 Plumbing
 - a. Sump pit and oil interceptor.
8. Division 23 Heating, Ventilation and Air Conditioning
 - a. Heating and ventilating hoistways and/or control room.

- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to

ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically, this will be at

the landing above the 1st floor. Final location must be coordinated with elevator contractor.

21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 inches thick. This is due to the controller being mounted on the second-floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right-hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

1.02 SUBMITTALS

- A. Product data: The elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
 1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
 4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Powder Coat paint, Plastic Laminate, and Metal selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Operation and maintenance data. Include the following:
 1. Owner's manuals and wiring diagrams.
 2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
 1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
 - a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.

b.

B. Regulatory Requirements:

1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)

C. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

D. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

- A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

- A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.

2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
3. Manufacturer shall have service office and full-time service personnel within a 100-mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Basis of design is based around thyssenkrupp Elevator's endura Machine Room-Less hydraulic elevator.

2.02 MATERIALS, GENERAL

- A. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
- B. Steel:
 1. Shapes and bars: Carbon.
 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
 3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.
- C. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.
- D. Flooring by others.

2.03 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.
- B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
- D. Guides: Slide guides shall be mounted on top and bottom of the car.
- E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

- F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..
- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
- H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. theoiltype
- I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform “flooded pit operation”, which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.
- J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
 - 1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
 - 2. An oil hydraulic pump.
 - 3. An electric motor.
 - 4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and

quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
 - 1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
 - 2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
 - 3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 - 4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
 - 5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
 - 6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
 - 7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
 - 8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
 - 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 - 2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish.
 - 3. Typical door & frame finish: Stainless steel panels, No. 4 brushed finish.
- B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

- C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details
- D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

- A. Car Enclosure:
 - 1. Walls: Cab type a laminate wall design, durable wood core finished on both sides with high pressure plastic laminate.
 - 2. Reveals and frieze: Not applicable
 - 3. Canopy: Cold-rolled steel with hinged exit.
 - 4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in a metal frame. Framework shall be finished with a stainless steel, no. 4 brushed finish.
 - 5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with No. 4 brushed stainless steel
 - 6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
 - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
 - b. Cab Sills: Extruded aluminum, mill finish.
 - 7. Handrail: Provide 2" flat metal bar rear wall. Handrails shall have a stainless steel, No. 4 brushed finish.
 - 8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
 - 9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete

control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
 5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
 7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
 8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

- B. Door Protection Device: Provide a door protection system using microprocessor controlled infrared light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a No. 4 brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.
- C. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

2.09 CONTROL SYSTEMS

- A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
 1. Access to main control board and CPU
 2. Main controller diagnostics
 3. Main controller fuses
 4. Universal Interface Tool (UIT)
 5. Remote valve adjustment
 6. Electronic motor starter adjustment and diagnostics
 7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
 8. Operation of auxiliary pump/motor (secondary hydraulic power source)
 9. Operation of electrical assisted manual lowering
 10. Provide male plug to supply 110VAC into the controller
 11. Run/Stop button

- C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- D. Emergency Power Operation: Full automatic operation (Simplex 10-D4A) Upon loss of the normal power supply, building-supplied standby power is available to the elevator on the same wires as the normal power. Once the loss of normal power has been detected and standby power is available, the elevator is lowered to a pre-designated landing and will open the doors. After passengers have exited the elevator, the doors are closed. At this time the elevator is automatically allowed to continue service using the building-supplied standby power.
- E. Special Operation: Provide provisions for a Card Reader to be installed in Hall Stations at both landings by other trades.

2.10 HALL STATIONS

- A. Hall Stations, General: Provide buttons with white-illuminating or blue-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
 - 1. Provide one pushbutton riser with faceplates having a No. 4 brushed stainless steel finish.
 - a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Special Equipment: Provide provisions in the Car Operating Station for a Card Reader to be installed by other trades.

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
- B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.
- C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
 - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
 - 2. Comply with the National Electrical Code for electrical work required during installation.
- B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
- C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
- D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.
- E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
- G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
- H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

- I. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.
- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of

failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1

1. Elevator Model: enduraMRL Above-Ground (1-stage)
2. Elevator Type: Hydraulic Machine Room-Less, Passenger
3. Rated Capacity: 3500 lbs.
4. Rated Speed: 80 ft./min.
5. Operation System: TAC32H
6. Travel: 13'-0"
7. Landings: 2 total
8. Openings:
 - a. Front: 2
 - b. Rear: 0
9. Clear Car Inside: 6' - 8" wide x 5' - 5" deep
10. Cab Height: 8'-0" standard
11. Hoistway Entrance Size: 3' - 6" wide x 7'-0" high
12. Door Type: Center Opening
13. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
14. Seismic Requirements: Zone 2
15. Hoistway Dimensions: 8' - 4" wide x 6' - 11" deep
16. Pit Depth: 5' - 0"
17. Button & Fixture Style: Signa4 Signal Fixtures
18. Special Operations: Card Reader Operation

END OF SECTION