

SCHRADERGROUP

Volume 2

DIVISION 02 – DIVISION 14



Prepared for:

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New Facility Project:

Bertie County 911 Communications

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SECTION 023000 – SUBSURFACE INVESTIGATION

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 WORK ALREADY PERFORMED

- A. Subsurface exploration investigations conducted at the Site, results of which are to be found in the Report of Subsurface Investigation and Geotechnical Engineering Services prepared by: Terracon, dated May 22, 2025

1.3 INTERPRETATION/DISCLAIMER

- A. It shall be the Contractor's obligation to satisfy himself as to the nature, character, quality and quantity of subsurface conditions likely to be encountered. Any reliance upon the subsurface information made available by the Owner or the Engineer shall be at the Contractor's risk. The Contractor agrees that he shall neither have nor assert against the Owner or Engineer any claim for damages for extra work or otherwise or for relief from any obligation of this Contract based upon the failure by the Owner or A/E to obtain or furnish additional subsurface information or to furnish all subsurface information in the Owner's or A/E 's possession or based upon any inadequacy or inaccuracy of the information provided.
- B. Complete Subsurface Investigation and Geotechnical Foundation Report is included for review as part of this section. However, this report and any other subsurface information which may be shown on separate sheets or otherwise made available by the Owner or Engineer to Bidders, Contractors and other interested parties shall not be considered as part of the contract documents or contract drawings, it being understood that such subsurface data is obtained solely for the purpose of design, and is provided to the Contractor only for general familiarization with the site subsurface conditions and is provided without express or implied representation, assurance or guarantee that the information is adequate, complete or correct or that it represents a true picture of the subsurface conditions to be encountered or that all pertinent subsurface information in the possession of the Owner or A/E has been furnished.

PART 2 - PRODUCTS

- A. Not Applicable

PART 3 - EXECUTIONS

3.1 EXAMINATION

- A. Bidders are urged to examine soils investigation data and to make their own independent assessment of the subsurface conditions and how they will affect construction activities (methods, scheduling, etc.) and to this end should arrange with a geotechnical specialist for their own appropriate subsurface investigation and interpretation.

3.2 LOCATION OF BORINGS

- A. Exploration boring logs and locations are included as part of the attached Geotechnical Investigation Report.

END OF SECTION 023000

SECTION 033000 - 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.
- B. Specification Section 033050: Cast-In-Place Concrete Slabs

1.2 WORK INCLUDED

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, concrete topping, placement procedures and finishes.
 - 1. Footings
 - 2. Piers.

1.3 STANDARDS OF PRACTICE

- A. Detailed recommendations for acceptable practices, while not necessarily a part of these specifications, are available in the following standards and recommendations of the American Concrete Institute (ACI):
 - 1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 214 – Guide to Evaluation of Strength Test Results of Concrete.
 - 3. ACI 301 – Specifications for Structural Concrete.
 - 4. ACI 315 – Guide to Presenting Reinforcing Steel Design Details.
 - 5. ACI 318 – Building Code Requirements for Structural Concrete.
 - 6. ACI 347 – Guide to Formwork for Concrete.
 - 7. ACI 306 – Guide to Cold Weather Concreting.
 - 8. ACI 305 – Guide to Hot Weather Concreting.
 - 9. ACI 309 – Guide for Consolidation of Concrete.
 - 10. ACI 211 – Proportioning Concrete Mixtures.

11. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.

- B. Concrete Reinforcing Steel Institute (CRSI)
- C. All standards and recommendations shall be the latest revisions of same at time of bidding, and as listed in the corresponding IBC Referenced Standards.

1.4 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one (1) or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag and silica fume.

1.5 PRE-INSTALLATION MEETINGS

- A. Conduct concrete pre-installation meeting(s) at project site in accordance with requirements of Division 01 Specifications.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Design professional(s).
 - f. Construction Manager.
 - g. Special Inspection agency.
 - 2. Review inspection and testing procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor barrier installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete mixture. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to *ACI 315 – Guide to Presenting Reinforcing Steel Design Details*. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement and supports of concrete reinforcement.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Coarse Aggregate
 - 2. Fine Aggregate
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing materials.
 - 5. Bonding agents.
 - 6. Adhesives.
 - 7. Epoxy joint filler.
 - 8. Joint-filler strips.
 - 9. Repair materials.
- F. Field quality control test and inspection reports.

1.7 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 complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association'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, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 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. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will 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. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC or rubber strips; size as indicated on Drawings.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1" (25 mm) to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1" (25 mm) in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.4 REINFORCEMENT ACCESSORIES

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

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III:
- B. Fly Ash: ASTM C618, Class C or F.
- C. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- D. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Use largest practical aggregate size for each mix specification.
 - 2. Coarse and fine aggregate shall be free of materials with deleterious reactivity to alkali in cement.
- E. Water: Clean and potable.

2.6 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Air-Entraining Admixture: ASTM C260.
 - 2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 3. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 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 and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 1. Available Products:
 - a. The Euclid Chemical Company; Eucobar.
 - b. L&M Construction Chemicals, Inc.; E-Con.
 - c. Meadows, W. R., Inc.; Sealtight Evapre.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film, white burlap-polyethylene sheet, or natural cellulose fabric.
- D. Water: Clean and potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 1. Available Products:
 - a. The Euclid Chemical Company; Kurez DR VOX.
 - b. L&M Construction Chemicals, Inc.; L&M Cure R.
 - c. Meadows, W. R., Inc.; 1100 Clear.

2.8 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C 881, 2-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

2. Types I and II, non-load-bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 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.
 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, and ground granulated blast-furnace slag as needed to reduce the total amount of Portland cement, which would otherwise be used. Limit percentage, by weight, of cement-replacement materials to a combined total of no more than 20-percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions, and as required for concrete placement and workability.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Provide normal weight concrete.
- B. Footings, foundation walls, and piers:
 1. Minimum Compressive Strength: 4,000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 5 inches, plus or minus 1 inch (without superplasticizer).
 4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 5. Coarse/Fine Aggregate Ratio: Quantity of coarse aggregate (by weight) shall be in the range of 1.2- to 1.4-times the quantity of fine aggregate (by weight).
 6. Exposure Class: ACI 318 – F1, S0, W0, C1

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete according to ASTM C 94 and furnish batch ticket information.
- B. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85°F and 90°F (30°C and 32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.
- C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until concrete 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.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8".
 - 2. Class B, 1/4".
 - 3. Class C, 1/2".

- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate 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. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
- 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.
- 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.
- M. Where soil conditions are suitable earth-forming is permitted to construct isolated column footings and continuous wall footings:
 - 1. Earth-formed footing dimensions shall be no less than the footing dimensions specified on the Contract Documents.
 - 2. Sides of earth-formed excavations shall be sloped as dictated by soil conditions to prevent soil from sloughing into excavated area and wet concrete.
 - 3. Ensure tops of footings are placed in accordance with the elevations specified on the Contract Documents.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 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."

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°F (10°C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. 28-day design compressive strength.
 - 2. At least 70% of 28-day design compressive strength.
 - 3. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 - 4. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. 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 Professional.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

- B. Clean reinforcement of loose rust and mill scale, earth, ice and other foreign materials.
- C. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

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 Professional.
 - 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 from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2" (38 mm) into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and that required inspections have been performed.
- B. Batch ticket for concrete shall clearly indicate mix design numbers which correlates with approved mix design.
- C. Do not add water to concrete during delivery, at Project site or during placement, unless approved by concrete plant supplier.
- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be 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 specified. Deposit concrete to avoid segregation.

- E. Deposit concrete in forms in horizontal layers no deeper than 24" (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator.
 - 3. Place vibrators to rapidly penetrate placed layer and at least 6" (150 mm) into preceding layer. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

3.7 COLD- AND HOT-WEATHER CONCRETE PLACEMENT

- A. Cold-Weather Placement: in accordance with ACI 306 – Guide to Cold Weather Concreting.
- B. Hot-Weather Placement: in accordance with ACI 305 – Guide to Hot Weather Concreting.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- 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 defective areas. Remove fins and other projections exceeding 1/8" (3 mm) in height.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster or painting.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than 1 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 will match 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.
- 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 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete 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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE PROTECTION 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 with recommendations in ACI 305R 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, bull-floating and/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 the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days.
 - 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" (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 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 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

- A. Prepare, clean and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds and sealers from joints; leave contact faces of joint clean and dry.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Professional. Remove and replace concrete that cannot be repaired and patched to Professional's approval.
- B. Materials: Provide patching materials corresponding to the type of patch required. Submit patching and repair product information for review and approval prior to application.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: 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. Verification of use of required design mixture(s).
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 50 cubic yards or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide 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, 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 and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, 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.
 - b. Contractor, at their discretion, may cast and field-cure cylinder specimens for their use.
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. 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).
9. Test results shall be reported in writing to Design Professional, 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.
10. 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. 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.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Where earth-forming methods are used to construct footings, it is the responsibility of the Contractor placing the concrete to ensure that the foundation elements are constructed to accurate dimensions and elevations. It is also the responsibility of the Contractor placing the concrete to correct any deficiencies or errors that affect the Work of other trades. Any corrective work shall be performed at the expense of the Contractor responsible for placing the concrete.

END OF SECTION 033000

SECTION 033050 - CAST-IN-PLACE CONCRETE SLABS

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.
- B. Specification Section 033000: Cast-In-Place Concrete

1.2 WORK INCLUDED

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, concrete topping, placement procedures and finishes.
 - 1. On-grade concrete slabs.
 - 2. On-deck concrete slabs.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, bent bar diagrams, arrangement and supports of concrete reinforcement. Use of Contract Drawings as Foundation Shop Drawings shall not be permitted.
- D. Construction and Contraction Joint Layout Drawings with joints clearly labeled, for on-grade and on-deck slabs.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.

4. Curing materials.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Epoxy joint filler.
9. Joint Filler strips.
10. Repair materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Comply with applicable articles of Division 01 Section "Quality Assurance Testing and Inspection Services." Owner will engage a qualified independent testing and inspecting agency.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PRODUCTS

2.1 STEEL BAR REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Galvanized Reinforcing Bars: ASTM A615, Grade 60, deformed bars; ASTM A767, Class II, galvanized after fabrication and bending.

- C. Epoxy-Coated Reinforcing Bars: ASTM A615, Grade 60, deformed bars; ASTM A775, epoxy-coated after fabrication and bending.

2.2 FIBER REINFORCEMENT

- A. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 3/4 to 1-1/2 inches long.
 - 1. Available Manufacturers:
 - a. Euclid Chemical Company.
 - b. FORTA Corporation.
 - c. Grace Construction Products, W. R. Grace & Co.
 - 2. Minimum dosage rate where required: 1.5 lb/cy or higher if recommended by manufacturer.

2.3 VAPOR BARRIERS

- A. Plastic Vapor Barrier: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Available Products:
 - a. Fortifiber Corporation; Moistop Ultra 15.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Reef Industries, Inc.; Griffolyn Type-105.
 - d. Stego Industries, LLC: Stego Wrap Vapor Barrier, 15-mil.

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic or precast concrete or fiber-reinforced concrete 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 or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.
- C. Joint Dowel Plates: 1/4" x 4 1/2" x 4 1/2", ASTM A36 plates
 - 1. Basis of Design Product: Diamond Dowel System by PNA Construction Technologies (www.pna-inc.com); or accepted equivalent.
 - 2. Install at all locations shown on Drawings.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I:
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Use largest practical aggregate size for each mix specification.
- C. Water: Clean and potable.

2.6 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Air-Entraining Admixture: ASTM C260.
 - 2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 3. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 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 and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Available Products:
 - a. Euclid Chemical Company (The); Eucobar.
 - b. L&M Construction Chemicals, Inc.; E-Con.
 - c. Meadows, W. R., Inc.; Sealtight Evapre.
- 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, white burlap-polyethylene sheet or natural cellulose fabric.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Available Products:
 - a. Euclid Chemical Company (The); Kurez DR VOX.

- b. L&M Construction Chemicals, Inc.; L&M Cure R.
- c. Meadows, W. R., Inc.; 1100 Clear.

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. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.9 CONCRETE MIXES, 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.
- B. Cement-Replacement Materials: Use fly ash, pozzolan, and ground granulated blast-furnace slag as needed to reduce the total amount of Portland cement that would otherwise be used. Limit percentage, by weight, of cement-replacement materials in concrete to a combined total of no more than 20-percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions, and as required for concrete placement and workability.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. On-Grade Interior Slabs: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3,000 psi at 28 days.
 - 2. Maximum Cementitious Materials Content: 540 lb/cu. yd.; use Portland Cement only; cementitious replacement materials (Fly Ash, GGBFS, etc) are not permitted.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch (without superplasticizer).
 - 4. Air Content: Limit to entrapped air. Do not use air-entraining admixtures.
 - 5. Coarse/Fine Aggregate Ratio: Quantity of coarse aggregate (by weight) shall be in the range of 1.2- to 1.4-times the quantity of fine aggregate (by weight).
- B. On-Grade Exterior Slabs: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4,500 psi at 28 days.
 - 2. Maximum Cementitious Materials Content: 611 lb/cu. yd.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch (without superplasticizer)

4. Air Content: 5 percent, plus or minus 1.5 percent, for 1-inch nominal maximum aggregate size.
 5. Coarse/Fine Aggregate Ratio: Quantity of coarse aggregate (by weight) shall be in the range of 1.2- to 1.4-times the quantity of fine aggregate (by weight).
- C. On-Deck Interior Slabs: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4,000 psi at 28 days.
 2. Maximum Cementitious Materials Content: 564 lb/cu. yd.
 3. Slump Limit: 5 inches, plus or minus 1/2 inch (without superplasticizer).
 4. Air Content: Limit to entrapped air. Do not use air-entraining admixtures.
 5. Coarse/Fine Aggregate Ratio: Quantity of coarse aggregate (by weight) shall be in the range of 1.2- to 1.4-times the quantity of fine aggregate (by weight).

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 1. When air temperature is between 85°F and 90°F (30°C and 32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct forms tight enough to prevent loss of concrete mortar.
- C. 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.

- D. 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.
- E. Chamfer exterior corners and edges of permanently exposed concrete.
- F. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 REMOVING AND REUSING FORMS

- A. Leave formwork for structural elements in place until concrete has achieved at least 75% of its 28-day design compressive strength.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be 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 Professional.

3.4 VAPOR BARRIERS

- A. Plastic Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
2. Terminate at slab edges by turning vapor barrier sheet up vertical wall surface and sealing in accordance with detail shown on Drawings.
3. Seal around all barrier penetrations (conduit, pipes, etc) in accordance with manufacturer's instructions.
4. Prior to concrete placement, inspect vapor barrier surface and repair all damaged, punctured, or torn areas.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing 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.
- 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.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. In on-grade slab locations, provide reinforcing bar supports with base/foot sections that eliminate or minimize the potential to damage the plastic vapor barrier, and position the upper layer of reinforcing bars to provide 1 1/2 inches of concrete cover when the slab concrete is placed.

3.6 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 Professional.
 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 from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2" (38 mm) into concrete.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Sawcut Contraction or Control Joints in On-Grade Slabs: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least 1/4 of concrete thickness, as follows:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8" wide joints into concrete when cutting action will 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" (12 mm) or more than 1" (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than 1 length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and that required inspections have been performed.
- B. Batch ticket for concrete shall clearly indicate mix design numbers that correlate with approved mix designs.
- C. Do not add water to concrete during delivery, at Project site or during placement, unless specifically required by the concrete producer.
- D. Concrete Placement: On-Deck (elevated) Floor Slabs:
 1. The on-deck concrete slab thickness indicated on the Drawings is a minimum thickness requirement.
 2. Concrete shall be placed with a varying thickness to accommodate deflection of structural framing under the weight of wet concrete and provide a flat, level and finished concrete surface at the specified elevation.
- 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.

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. Screed 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, free of humps or hollows, before excess moisture or bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with applicable provisions of ACI 306.
- G. Hot-Weather Placement: Comply with applicable provisions of ACI 305.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
1. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. 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 restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. 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 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.

- E. Trowel and Fine-Broom Finish: While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method.
 - 2. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: 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.
 - 1. Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

3.9 FLOOR SLAB FLATNESS AND LEVELNESS

- A. Definitions:
 - 1. SOF_F – Specified Overall Flatness Value
 - 2. SOF_L – Specified Overall Levelness Value
 - 3. MLF_F - Specified Minimum Local Flatness Value
 - 4. MLF_L – Specified Minimum Local Levelness Value
- B. For all locations of on-grade concrete slabs, the flatness and levelness requirements are as follows:
 - 1. SOF_F -25 and MLF_F -13
 - 2. SOF_L -17 and MLF_L -10
- C. For all locations of on-deck (elevated) concrete slabs, the flatness requirements are as follows:
 - 1. SOF_F -25 and MLF_F -13

3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete slabs from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R 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. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings and other surfaces, by 1 or a combination of the following methods:
1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12" (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than 7 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 recommends for use with floor coverings.
 2. 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 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 3. 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 3 hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

- A. Prepare, clean and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds and sealers from joints; leave contact faces of joint clean and dry.

3.12 FIELD QUALITY CONTROL

- A. General:
 1. Concrete materials and operation will be tested and inspected as work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Professional for final acceptance.
 2. Comply with Division 01 Section "Quality Control Testing Services" for sampling and testing of concrete.

3. Testing of field curing test cylinders or testing required because of changes in materials or proportions of the mix requested by the Contractor, as well as any extra testing of concrete or materials occasioned by their failure to meet specification requirements, shall be at the Contractor's expense.
- B. Testing Services by Quality Control Agency:
1. The Owner reserves the right to have check tests performed in accordance with Division 01 Section "Quality Assurance Testing and Inspection Services" on any and all testing and inspections required by Division 01 Section "Quality Control Testing Services."
 2. Refer to Specification Section 033000.
 - a. Samples for strength tests of each class of concrete (each concrete mix design) shall be taken not less than once a day nor less than once for each 50 cubic yards of concrete or for each 3000 sq.ft. of surface area placed.

END OF SECTION 033050

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SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
- 2. Mortar and grout.
- 3. Steel reinforcing bars.
- 4. Masonry joint reinforcement.
- 5. Miscellaneous masonry accessories.
- 6. Mortar and Grout Mixes
- 7. Mock-up Panel

- B. Related Sections:

- 1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
- 2. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
- 3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: 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.
 - 2. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 3. Show elevations of all reinforced masonry walls including, but not limited to, locations of all vertical and horizontal reinforcing bars, bond beams, openings, vertical control joints, and other embedded items.

1.7 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

- A. 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.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. 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.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1,900 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Built-in-place masonry lintels made from header block or bond beam CMUs, as indicated on Drawings, with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

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 standard mortar color.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Masonry Cement: Not permitted.
- D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

F. Aggregate for Grout: ASTM C 404.

G. Water: Potable.

H. Admixtures: Not permitted in mortar or grout.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

B. Masonry Joint Reinforcement for Interior Walls, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior and foundation walls: Stainless steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Veneers Anchored to Concrete Masonry walls with Seismic Masonry-Veneer Anchors:

1. Basis of Design is 265 SIS Ladder Adjustable Joint Reinforcement with Compressed Leg 2X-Hook and Seismiclip Interlock with Veneer Wire as manufactured by Hohmann & Barnard, Inc.:
 - a. Wire Size for Side Rods: 3/6"-diameter.
 - b. Wire Size for Cross Rods: 9 gauge
 - c. Wire Size for Continuous Veneer Wire: 9 gauge
 - d. Finish for All System Components: Stainless Steel.
2. Spacing of Cross Rods and Ties: Not more than 16" on center.
3. Install prefabricated corners and tees.

2.6 TIES AND ANCHORS

A. Adjustable Masonry-Veneer Anchors:

1. For connection to Concrete Masonry walls, the Basis of Design is Thermal Concrete 2-Seal Wing Nut Anchor as manufactured by Hohmann & Barnard, Inc.:
 - a. Anchor length compatible with installation across wall cavity and rigid insulation, and anchored into CMU wall construction with polymer-coated, carbon steel screw and EPDM washers.
 - b. Tie Section: Compressed-Leg 2X Hook with 3/16"-diameter round wire.
 - c. Finish: Hot-dip galvanized, carbon steel.

2. For connection to Cold-Formed Metal Framing stud walls, the Basis of Design is 2-Seal Thermal Wing Nut Anchor as manufactured by Hohmann & Barnard, Inc.:
 - a. Anchor length compatible with installation across wall cavity and rigid insulation, and anchored into metal stud wall construction with polymer-coated, carbon steel screw and EPDM washers.
 - b. Tie Section: Compressed-Leg 2X Hook with 3/16"-diameter round wire.
 - c. Finish: Hot-dip galvanized, carbon steel.

2.7 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Post-installed Anchors: chemical anchors.
 1. Load Capacity: 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.
 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 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. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.9 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.
- B. Pre-blended, PCL Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M or Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S or Type N.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; and for other applications where another type is not indicated, use Type S.
 - 5. For interior non-load-bearing partitions, Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476 Proportion Specification.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
 - 4. Do not use admixtures in grout.

2.10 MOCK-UP PANEL

- A. Sample Mock-up Panel: Before installing unit masonry and Brick Masonry, build sample panel, 4'-0"W x 4'-0"H, using materials indicated for the complete Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes as shown in drawings. Include, cavity, ties, weeps, window jamb/sill, and insulation in sample.
 - 1. Locate mock-up panel as directed by Architect.
 - 2. Clean exposed faces of panel with masonry cleaner indicated.
 - 3. Protect approved sample panel from the elements with weather resistant membrane.
 - 4. Maintain sample panel during construction in an undisturbed condition as a standard for judging the completed Work.

5. Approval of sample panel is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry and brick unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 1. Mix units from several pallets or cubes as they are placed.

3.3 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.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

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 exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- #### A.
- Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns,

and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. 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.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using the specified veneer-anchoring systems. Refer to Drawings for additional information.
- 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.

3.7 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. vertically.
 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.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached 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. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
3. Embed 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.
4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.9 CONTROL JOINTS

- A. General: Install control joint materials in unit masonry as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

- A. Install steel lintels only where indicated.
- B. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 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. Contractor has option to place grout by either low-lift or high-lift grouting procedure and shall follow the corresponding procedures, techniques, and methodologies described in ACI 530.1/ASCE 6/TMS 602 and NCMA TEK bulletin 3-2 Grouting Concrete Masonry Walls.

3.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: 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 2 Special Inspections according to the North Carolina Building Code.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, 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. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, 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.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
 - 8. Clean stone trim to comply with stone supplier's written instructions.

END OF SECTION 042000

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SECTION 042113 - BRICK MASONRY

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. Face brick.
 - 2. Mortar and grout.
 - 3. Ties and anchors.
 - 4. Embedded flashing.
 - 5. Miscellaneous masonry accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples: For each type and color of the following:
 - 1. Face brick: full size units showing the full range of exposed colors, textures, and dimensions to be used on the Project.
 - 2. Special brick shapes.
 - 3. Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 - 4. Weep holes.
 - 5. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.

- b. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - 2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 3. Grout mixes. Include description of type and proportions of ingredients.
 - 4. Anchors, ties, and metal accessories.
- B. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mock-Up Sample Panels: Before installing face brick, build sample panels, using materials indicated for the complete Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels (Reference architectural series drawings for exterior finish materials layout and arrangement) by full thickness. Include, cavity, ties, weeps, window jamb/sill, and insulation in sample.
 - 1. Locate panels as directed by Architect.
 - 2. Clean exposed faces of panels with masonry cleaner indicated.
 - 3. Protect approved sample panels from the elements with weather resistant membrane.
 - 4. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. 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.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. 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.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps, corbels, 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 requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
- B. Face Brick: Facing brick complying with ASTM C 216. Provide the following:
1. Provide basis of design as listed below, or approved equal:
 2. Basis of Design: General Shale Brick: www.generalshale.com/#sle.
 - a. Texture: match Architect's sample – wirecut.
 - b. Color: match Architect's sample – Oyster Bay (by General Shales)
 - c. Size: 3-5/8 inches wide by 3-5/8 high by 11-5/8 inches long, unless otherwise indicated.
 - d. Grade: SW
 - e. Type: FBS
 - f. Initial Rate of Absorption: Less than 30 g/30 sq. in per minute when tested per ASTM C 67.
 - g. Efflorescence: Provide Brick that has been tested according to ASTM C67 and is rated "not effloresced."
 3. Adams Products: match architect's sample. <https://adamsproducts.com/>
 4. Taylor Clay Products, Inc.: match architect's sample. <https://taylorclaybrick.com>

2.2 MORTAR 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. Color(s): As selected by Architect from manufacturer's standard range.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- E. Masonry Cement: Not permitted.
- F. Admixtures: Not permitted.
- G. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

2.3 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
- B. Adjustable Masonry-Veneer Anchors:
 - 1. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - 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) Dayton Superior Corporation, Dur-O-Wal Division; D/A 210 with D/A 700-708.
 - 2) Heckmann Building Products, Inc; 315-D with 316.
 - 3) Hohmann & Barnard, Inc; DW-10.
 - 4) Wire-Bond; 1004, Type III.
 - b. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 9 inches (229 mm) long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 5-1/2 inches (140 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - 2. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
 - 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) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
 - 2) ITW Buildex; Illinois Tool Works, Inc; Scots long life Tek.

2.4 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 - 2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.

- 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) Cheney Flashing Company; Cheney 3-Way Flashing (Sawtooth).
 - 2) Keystone Flashing Company, Inc; Keystone 3-Way Interlocking Thruwall Flashing.
 - 3) Sandell Manufacturing Co., Inc; Mechanically Keyed Flashing.
- 3. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.
- B. Solder and Sealants for Sheet Metal Flashings:
 - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, 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) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Blok-Lok Limited; Cell-Vent.
 - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 5) Wire-Bond; Cell Vent.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 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. Advanced Building Products Inc; Mortar Break.
- b. CavClear/Archovations, Inc; Stone Mat.
- c. Dayton Superior Corporation, Dur-O-Wal Division; Polytime MortarStop.
- d. Mortar Net USA, Ltd; Mortar Net.

2. Provide one of the following configurations:

- a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.6 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Diedrich Technologies, Inc.
- b. EaCo Chem, Inc.
- c. PROSOCO, Inc.

2.7 MORTAR 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.
2. Use Portland cement-lime mortar unless otherwise indicated.

- 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 brick-masonry veneer use Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, 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. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. 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.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Running Bond with 33 percent offset.
- 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.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

- 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 joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Provide not less than 2 inches (50 mm) 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 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

3.6 EXPANSION JOINTS

- A. General: Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints in brick as follows:
 - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 - 3. Build in compressible joint fillers where indicated.
 - 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 LINTELS

- A. Install lintels where indicated.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, 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. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, 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 masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
 - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
- 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. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - 3. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.9 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, 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.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.10 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste: Remove excess clean masonry waste and legally dispose of off Owner's property.

END OF SECTION 042113

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SECTION 051200 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 5 Section "Steel Deck" for field installation of shear connectors.
 - 3. Division 5 Section "Steel Joists".
 - 4. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
 - 5. Division 9 painting Sections for surface preparation and priming requirements.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - 2. ASTM A36 – Standard Specification for Carbon Structural Steel.
 - 3. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 4. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
 - 5. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 6. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength.
 - 7. ASTM A325 – Standard Specification for High Strength Structural Bolts and Assemblies.

8. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
9. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
10. ASTM A992 – Standard Specification for Structural Steel Shapes.
11. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
12. ASTM F436 – Standard Specification for Hardened Steel Washers.
13. ASTM F959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for use with Structural Fasteners.
14. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength.
15. ASTM F1852 – Standard Specification for “Twist-Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

B. AWS D1.1 - Structural Welding Code.

C. American Institute of Steel Construction (AISC):

1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. AISC - Code of Standard Practice for Steel Buildings and Bridges.
3. AISC - Specification for Structural Joints using ASTM A325 or A490 Bolts.

D. SSPC - Steel Structures Painting Council - Painting Manual.

1.4 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.5 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated on Drawings and comply with other information and restrictions indicated.
1. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

1.6 SUBMITTALS

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

- B. Samples for Initial Selection: For products involving selection of color, texture, or design.
- C. 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.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
 - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 QUALITY ASSURANCE

Fabricator Qualifications: A qualified steel fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.

- A. Installer Qualifications: A qualified steel erector with a minimum of 10 years of experience performing work of a nature similar to this project, and is acceptable to the Fabricator.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

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 erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
- B. 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.

1.9 COORDINATION

- A. Furnish 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.
- B. Coordinate selection and application of shop primers with finish top coating requirements. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W- and WT-Shapes: ASTM A992.
- B. Channels, Angles, Plate, and Bar Shapes: ASTM A36.
- C. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.
- D. Steel Pipe: ASTM A53, Grade B.
- E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts.
 - 1. Finish: Plain, unless noted otherwise on Drawings.
- B. Unheaded Anchor Rods: ASTM F1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A563 heavy hex carbon steel.
 - 3. Plate Washers: ASTM A36 carbon steel.
 - 4. Washers: ASTM F436 hardened carbon steel.
 - 5. Finish: Plain, unless noted otherwise on Drawings.
- C. Threaded Rods: ASTM A 36.
 - 1. Nuts: ASTM A563 hex carbon steel.
 - 2. Washers and Plate Washers: ASTM A36 carbon steel.
 - 3. Finish: Plain, unless noted otherwise on Drawings.

2.3 PRIMER

- A. Primer for Concealed Elements: Shop primer is not required for structural steel elements that will be enclosed within the building envelope and concealed in the final Work of the Project.
- B. Primer for Exposed Elements: Coordinate with Division 9 requirements of finish painting and top coating for all structural steel framing components that will remain outside the building envelope or will remain exposed to view in final Work of the Project.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings".
- 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.
- 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. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1.

2.6 CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless noted otherwise on Drawings.
 - 2. High-strength bolts shall not be used in combination with welds to share load transmission in the same connection, except as indicated in Chapter J of AISC's Specification for Structural Steel Buildings.

3. All bolts shall be new and well-lubricated at the time of installation.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.

2.7 THERMAL BREAK MATERIAL

A. Basis of Design Product: Armatherm FRR Structural Thermal Break Material by Armatherm Thermal Bridging Solutions, Acushnet, MA (www.armatherm.com)

B. Install thermal break material in connections indicated on Drawings.

2.8 SHOP PRIMING

A. Shop prime steel surfaces as required for top coating products that will be exposed in final Work of the Project. Otherwise, shop priming is not required for structural steel surfaces that will be concealed and within the building envelope in the final Work of the Project. Additionally, do not shop prime the following:

1. Surfaces to be field welded.
2. Surfaces to be galvanized.

B. Surface Preparation: Clean surfaces to be primed and coated. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with coating manufacturer's recommendations for surfaces that will receive finish coating and remain exposed to view in final Work.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize components indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- 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.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- B. Base Plates: Clean concrete-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
 - 1. Set column base plates leveling plates or setting nuts as detailed.
 - 2. Where required, weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed.
 - 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure in accordance with manufacturer's installation instructions.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be 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 A325 or A490 Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, 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 will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, all partial- and complete-joint-penetration (PJP and CJP) field welds will be tested according to AWS D1.1 and one of the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 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 on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Restore finishes damaged during installation and construction period so no evidence remains of corrective work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
- C. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.
- E. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 051200

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SECTION 053100 - STEEL DECK

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 WORK INCLUDED

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite Floor Deck.
 - 3. Deck Accessories.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Assurance Testing and Inspection Services."
 - 2. Division 03 Section "Cast-in-Place Concrete Slabs" for concrete fill and reinforcing steel.
 - 3. Division 05 Section "Structural Steel" for shop-installed connectors.
 - 4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories and attachments to other construction. The use of Contract Drawings for use as Shop Drawings shall not be permitted.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Mechanical fasteners.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel" and AWS D1.3, "Structural Welding Code--Sheet Steel."
- C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- D. Comply with applicable articles of Division 01 Section "Quality Assurance Testing and Inspection Services."

1.5 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Canam Steel Corporation; Canam Group, Inc.
2. New Millenium Building Systems, LLC
3. Epic Metals Corporation
4. Nucor Corporation, Vulcraft Division
5. Roof Deck, Inc.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29 and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel, Grade 40, G60 zinc coating.
2. Deck Profile: As indicated on Drawings.
3. Profile Depth: As indicated on Drawings.
4. Design Uncoated-Steel Thickness: As indicated on Drawings.
5. Span Condition: Two-span continuous (minimum); unless indicated otherwise on Drawings.

2.3 COMPOSITE STEEL 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. 29, the minimum section properties indicated and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel, Grade 40, G60 zinc coating.
2. Deck Profile: As indicated on Drawings
3. Design Uncoated-Steel Thickness: As indicated on Drawings.

4. Span Condition: Two-span continuous (minimum); unless indicated otherwise on Drawings.

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" (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish and thickness as deck, unless otherwise indicated.
- G. 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.
- H. Column Closures, End Closures, Z-Closures and Cover Plates: Steel sheet, of same material, finish and thickness as deck, unless otherwise indicated.
- I. Exposed end closures: 1/8" steel with hairline joints.
- J. Flat Sump Plate: Single-piece steel sheet, 0.0747" (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94% zinc dust by weight.

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.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, 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 decking 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 decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds and methods used for correcting welding work.

3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2" (38 mm) long and as follows:
- B. Weld Diameter: As indicated on Drawings
- C. Weld Spacing: As indicated on Drawings.
- D. Side-Lap and Perimeter Edge Fastening: As indicated on Drawings
- E. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2" (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2" (51 mm) minimum
- F. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12" (305 mm) apart with at least 1 weld at each corner.
- G. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- H. 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.
- I. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12" apart with at least 1 weld at each corner.
- J. Miscellaneous Acoustic Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- K. 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.

- L. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2", with end joints as follows:
 - 1. End Joints: Butt

3.4 FLOOR DECK INSTALLATION

- A. Weld Diameter: As Indicated on Drawings.
- B. Weld Spacing: As indicated on Drawings.
- C. 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 18" (450 mm) and as follows:
 - 1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.
 - 2. End Joints: Lapped 2" (51 mm) minimum
 - 3. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 - 4. 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.

3.5 FIELD QUALITY CONTROL

- A. Field welds will be subject to inspection by Quality Assurance Testing Agency.
- B. Testing agency will report test results promptly and in writing to Contractor and Professional.
- C. Remove and replace work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 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 Sections include the following:
 - 1. Division 4 Section "Unit Masonry" for masonry veneers tied and anchored to metal-stud framing.
 - 2. Division 9 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Design framing systems to provide for movement of framing members 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.
 - 3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

- F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- G. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Clark Steel Framing.
 - 2. Dietrich Metal Framing; a Worthington Industries Company.
 - 3. MarinoWare; a division of Ware Industries.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.

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: Minimum as indicated on Drawings and as required for structural performance.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and flange width minimum 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard 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 and lateral 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.
- 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.

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: Minimum as indicated on Drawings and as required for structural performance.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and flange width minimum 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard 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 and lateral 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.
- 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.

2.5 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Minimum as indicated on Drawings and as required for structural performance.
 - 2. Flange Width: 1-5/8 inches.

2.6 EXTERIOR SOFFIT FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Minimum as indicated on Drawings and as required for structural performance.
 - 2. Flange Width: 1-5/8 inches.

2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight 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 and 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. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. 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.
- E. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, 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: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION

- A. Fabricate cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 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 screw penetrating joined members by not less than three exposed screw threads.
- 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to 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.
- D. Install cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 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, and complying 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 comparable in intensity 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 and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing 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 standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

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 as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- 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-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. 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.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 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. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 055000 - 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. Miscellaneous steel framing and supports.
 - 2. Loose steel lintels.
 - 3. Metal ladders.
 - 4. Bollards.
 - 5. Downspout boots.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Delegated-Design Submittal: For ladders and their attachments to the building, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Informational Submittals:
 - 1. Qualification Data: for professional engineer.
 - 2. Paint Compatibility Certificates: from manufacturers for topcoats applied certifying compatibility with steel material and shop primers.

1.4 QUALITY ASSURANCE

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

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 METALS

- 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.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. Cast Iron: either gray iron, ASTM A48, or malleable iron, ASTM A 47, unless otherwise indicated.
- E. Aluminum:
 - 1. Aluminum Plate and Sheet: AST B 209, Alloy 6061-T6.
 - 2. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

3. Aluminum Castings: ASTM B 26, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- D. Post-Installed Anchors: Torque-controlled expansion anchors.
 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material for Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
- C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- E. 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.

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. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously. 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. Finish exposed welds smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.

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.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Provide hot-dipped galvanized lintels located in exterior walls.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. Space siderails 16 inches apart, unless otherwise indicated for elevator ladders.
3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges, unless otherwise indicated.
2. Rungs: 3/4-inch- diameter steel bars, unless otherwise indicated.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
5. Galvanize ladders including brackets and fasteners.
6. Ladder Safety Systems
 - a. Ladder Safety System: Comply with 29 CFR 1910.29, 29 CFR 1926.1053, and Section 7 of ANSI A14.3; ladder safety system allows the worker to climb up and down using both hands; does not require the employee continuously, hold, push, or pull any part of the system while climbing.
 - 1) Install on new fixed ladders over 24 feet in height.
 - 2) Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
 - 3) Rigid Carrier: Fixed 304 stainless steel U-shaped slotted track with top, bottom and intermediate supports.
 - a) Provide with stainless steel extension post at top of ladder.
 - 4) Manufacturers; Non-ANSI/ASSP Z359.16 compliant:

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Fabricate bollards with 3/8-inch thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Prime bollards with zinc-rich primer.

2.10 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Neenah R-4929

- B. Prime cast-iron downspout boots with zinc-rich primer.

2.11 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 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. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. 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.

2.13 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.
- 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.

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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

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SECTION 055213 - PIPE AND TUBE RAILINGS

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 pipe and tube railings.
 - 2. Stainless steel handrails.

1.3 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 for railings. 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.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 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 Initial Selection: For products involving selection of color, texture, or design.

- D. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
- E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Qualification Data: For testing agency.
- G. Welding certificates.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings 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. applied in any direction.
 - b. Concentrated load of 200 lbf 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 applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. 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, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

- A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- B. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- D. Woven-Wire Mesh: Intermediate-crimp, diamond pattern (90 degrees), 2-inch woven-wire mesh, made from 0.134-inch- diameter wire complying with ASTM A 510

2.4 STAINLESS STEEL

- A. Pipe: ASTM A 312/A 312M, Grade TP 304.
- B. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

2.5 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - 3. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide Phillips, tamper-resistant, or square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical 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.
 - 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 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

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

1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. 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. Intermediate Coats and Topcoats: Refer to Division 09 painting Sections.
- 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.
- F. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. 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.
- I. All exposed steel stair framing, and welding for structural members, railings and supports shall be designated as AESS. Reference specification section 051250 Architectural Exposed Structural Steel.
- J. Form changes in direction as follows:
 - 1. By radius bends of radius indicated. Mitered corners are not acceptable.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh as shown in drawings. Make wire mesh and frames from same metal as railings in which they are installed.
 - 1. Orient wire mesh as squares (90 degrees to finished floor) as shown in drawings.

2.8 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.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. 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.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 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. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.

2.9 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

1. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

- B. Perform cutting, drilling, and fitting required for installing railings. 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 have been 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.
 - 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.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Anchor posts to metal surfaces. Shop and field weld unless noted otherwise. Provide bolt/flange at non-metallic surfaces only.
- B. 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 as follows:
 - 1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends as indicated on Drawings.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall

surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket indicated.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. 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.

D. Refer to Section 099000 "Painting" for finish painting of railings.

3.6 ADJUSTING AND CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. 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 for touching up shop-prime and field paint surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

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SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

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. Wood blocking, furring, and nailers.
 - 2. Plywood backing panels.
 - 3. Wood treatment.
 - 4. Project identification sign (temporary).
 - 5. Roof blocking.
 - 6. Supplementary components and accessories.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA: National Lumber Grades Authority.
 - 2. SPIB: The Southern Pine Inspection Bureau.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.
- C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- D. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.

- 3. Power-driven fasteners.
- 4. Powder-actuated fasteners.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS20 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.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, or similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 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.

- B. For items of dimension lumber size, provide Standard, Stud, or No.3 grade lumber of any species.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS1, Exterior, C-D plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
2. Provide stainless steel type fasteners at all wood preservative treated materials including all roofing and exterior blocking.

- B. Nails, Brads, and Staples: ASTM F1667.

- C. Power-Driven Fasteners: NESNER-272.

- D. Wood Screws: ASME B18.6.1.

- E. Lag Bolts: ASME B18.2.1.

- F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NESNER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.4 PROJECT IDENTIFICATION SIGNS

- A. Sign shall be by General Contractor at location directed by Owner.
 - 1. Provide three full height 4-inch by 6-inch posts buried 3-1/2 feet in the ground with tamped earth around posts.
 - 2. Provide 4 ft. by 8 ft. sheets of 3/4-inch MDO exterior grade plywood for signage. Glue plywood edges together using biscuit joiners 18-inches o.c. with 100 percent construction adhesive coverage.
 - 3. Provide pine trim (two step) mitered at corners.
 - 4. All wood shall be pressure treated.
 - 5. Paint entire sign with primer and two coats of exterior gloss acrylic paint.
 - 6. Remove sign from site at completion of project and fill posts holes.

3.5 ROOF BLOCKING

- A. Stacked "Two-By" Blocking: Provide stacked pressure treated pine "two-by's" bolted to structure. Provide two glued and screwed plies of 3/4-inch thick pressure treated plugged C-D plywood in areas "two-by" material is not readily available in needed widths. Screw plies together 12-inches on center at staggered edge locations using #8 stainless steel bugle head screws, 1.5 inches long. Provide continuous ribbons of construction adhesive at both edges and in criss-cross fashion at 18-inch intervals. Stagger and overlap butt end (Ship lap) joints.
- B. Option: Contractor may use 3/4-inch thick pressure treated plywood boxes for blocking in lieu of stacked "two-by" blocking. Reinforce four inside corners using 2 by 4 inch continuous wood framing. Extend framing 12-inches minimum through box butt joints. Adhere plywood butt joints. Box in ends of blocking runs. Screw plywood sides, tops, and bottoms to framing 18-inches on center at staggered edge locations using #8 stainless steel bugle head screws, 1.5 inches long. Provide continuous ribbons of construction adhesive at all plywood and framing joints/ and mating surfaces.
- C. Fasten blocking and box bottoms to structure below using 3/8 inch diameter bolts 18 inches on center. Bolt heads shall have fender washers between head and wood. Countersink bolt heads at stacked "two-by's". Bolts shall extend through structural roof edge framing.

END OF SECTION 061053

SECTION 061600 - SHEATHING

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. Wall sheathing
 - 2. Parapet sheathing.
 - 3. Sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire

resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

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. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. United States Gypsum Co.; Securock.
2. Type and Thickness: Refer to Drawings.
3. Size: 48 by 96 inches.

B. Fire-Retardant-Treated Plywood Sheathing

1. General: Where FRT materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
2. Fire-Retardant-Treated Plywood by pressure process: products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - a. Use treatment that does not promote corrosion of metal fasteners.
 - b. Exterior type: treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - c. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/ D 3201M at 92 percent relative humidity. Use where exterior type is not required.
3. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped, or does not comply with requirements for untreated material.
4. Identify FRT plywood with appropriate classification marking of qualified testing agency.

5. Application: Treat plywood as indicated on drawings.

6. Type and Thickness: Refer to Drawings.

C. Parapet Sheathing

1. Plywood sheathing, parapets: DOC PS 1, Exterior Sheathing not less than 1/2 inch nominal thickness.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, 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 Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.

2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by 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."
- D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with nails or screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 064020 - INTERIOR ARCHITECTURAL WOODWORK

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. Plastic-laminate cabinets.
 - 2. Plastic-laminate countertops.
 - 3. Architectural wood trimwork.
- B. Related Sections include the following:
 - 1. Division 6 Section "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Division 7 Section "Joint Sealants."

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 INSPECTION REQUIREMENTS

- A. The following list of nonconforming work items are to be inspected by the Contractor during construction. Discovery and correction of nonconforming work is the responsibility of the Contractor.
- B. The Contractor shall identify and correct all nonconforming work items prior to work being covered up and prior to requesting the processing of the Certificate of Substantial Completion.
- C. Conforming Interior Architectural Woodwork work shall be capable of withstanding dead and live loads under normal use.
- D. Nonconforming work includes but is not limited to the following list of nonconforming work items:

1. Joinery shall not gap open or separate.
2. Wood shall not curl.
3. Wood shall not come loose from substrate.
4. Wood shall not ooze sap.
5. Wood shall not show glue smears on surface.
6. Visible machine marks made by planer, moulder, router, joiner, saw or sander.
7. Delamination of veneer or laminate.
8. Warping or curling of components causing misalignment of paneling, doors, drawers, or shelves.
9. Loose or failed operating hardware.
10. Cabinets falling off walls.
11. Moisture swelling of core wood products.
12. Scratched, chipped, or misaligned laminate.
13. Gapping of backsplash corners, tops-to-wall or separation from countertop.
14. Permanent shelf-sagging under uniformly distributed load of a full shelf of textbooks.
15. Cabinetry settlement due to non-uniform loading.
16. Wood finish shall not encapsulate sawdust or other foreign material.
17. Wood finish shall not show brush strokes, "orange peel" surface, or show exposed "holidays" of bare substrate or previous finish coat.
18. Wood finish shall not peel or alligator.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories, handrail brackets, clothes rods, fire treated wood, finishing materials and processes, high-pressure decorative laminate, solid-surfacing material, cabinet hardware and accessories, handrail brackets, and wood glue.
 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 1. Show details at 3-inches = 1-inch scale.
 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 3. Show locations and sizes of cutouts and holes for all building utilities and non-wood items installed in architectural woodwork.
- C. Samples or Finish Material for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
- D. Finished Samples: For the following:
 1. All finished samples shall have successive coats stepped back for each coat beginning with bare wood.

- a. Plastic-laminate-clad panel products, 8 by 10-inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
- E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing and installing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - 1. Provide AWI Quality Certification Program Certificate indicating that woodwork complies with requirements of grades specified.
 - 2. Comply with AWI Sections.
 - 3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
- C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 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.
 - 1. Maintain temperature between 60 and 90 degrees F.
 - 2. Maintain relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, building utilities, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Ag-Fiber: Blended bio-fiber composition with non-formaldehyde binders. Board shall exceed performance requirements for ANSI A208.1-1999 M3 Standards.
 - 2. Hardboard: AHA A135.4.
 - 3. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
 - 4. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 5. Hardwood Plywood and Face Veneers: HPVA HP-1.

- C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a. Formica Corporation.
 - b. Laminart.
 - c. Panolam Industries International, Inc., Pionite decorative surfaces
 - d. Wilsonart International; Div. of Premark International, Inc.
- E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement or cement.
- F. Approved by laminate and panel product manufacturer jointly.
- G. Water-resistant Wood Adhesive Glue: Titebond II, by Franklin International; Equals by DAP, Inc.; AAT, Inc., or Borden.
 - 1. Equals shall:
 - a. Exceed ANSI/HPMA HP 1983 Type II water-resistance test.
 - b. Be translucent when dry.
 - c. Have an ASTM D 905 bond strength on hard maple of 3,750 psi @ room temperature.
 - d. Conform to ASTM D 4236.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to authorities having jurisdiction to produce products with fire-test-response characteristics specified.
 - 1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with AWPA C20 (lumber) and AWPA C27 (plywood), for woodwork items indicated as fire-retardant treated. Use the following treatment type:
 - 1. Interior Type A: Low-hygroscopic formulation.

2. Mill lumber before or after treatment, within limits set for wood removal that does not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency. Before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 3. Kiln-dry material before and after treatment to levels required for untreated material.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread rating of 25 or less and smoke-developed rating of 25 or less per ASTM E 84.
1. For panels 3/4-inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: density, 45-lb/cu. ft; modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 lbf and 225 lbf, respectively.
 2. For panels 13/16 to 1-1/4-inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: density, 44-lb/cu. ft; modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 lbf and 175 lbf, respectively.
 3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Willamette Industries, Inc.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread rating of 25 or less and smoke-developed rating of 200 or less per ASTM E 84.
1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd; Medite Div.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware."
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:
1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- D. Wire Pulls: Back mounted, 4-inches long, 5/16-inches in diameter.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.

- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 BHMA A156.9, B04102; with shelf brackets, B04112.
- G. Shelf Rests: BHMA A156.9, B04013.
- H. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
 - 1. Box Drawer Slides: 75 lbf.
 - 2. File Drawer Slides: 150 lbf.
 - 3. Pencil Drawer Slides: 45 lbf.
 - 4. Keyboard Slide: 75 lbf.
- I. Door Locks: BHMA A156.11, E07121.
- J. Drawer Locks: BHMA A156.11, E07041.
- K. Grommets for Cable Passage through Countertops: Provide 2-inch diameter black grommet at each computer workstation (Reference Furniture Plans). Provide molded-plastic grommets and matching plastic caps with slot for wire passage.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- N. Backsplash Clips for Laminate Construction: Provide concealed nylon 3-screw clip fastened to countertop with two screws 12-inches on center. Two-way clip is designed to hold backsplash down onto countertop and back tight against (slightly curved) walls. Route bottom of backsplash and install screws lined up to engage clip.

2.4 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content and fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Fastening:
 - 1. Provide No. 10 oval head screws sized for 1-inch penetration into wood framing or blocking, and 3/4 of the way through hanging strips.
 - 2. Provide No. 10 oval head sheet metal screws into metal framing behind wall finish.
 - 3. Provide countersunk 3/16-inch diameter flat head concrete tapping screws into concrete or blocking walls. Screws and finishing washers at all screw heads shall be nickel-plated.

4. Provide Torx drive wood-to-metal trim head screw to fasten wood-to-wood and wood through gypsum drywall into metal studs. Screws shall be Fastenal No. 32089 Plus Series. Equals by ITT Buildex and Triangle Fasteners.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide custom grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease all edges to 1/16-inch radius.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 1. Seal edges of all openings cut in all panel products with a coat of varnish.

2.6 PLASTIC-LAMINATE CABINETS

- A. AWI Type of Cabinet Construction: Flush overlay Reveal overlay.
- B. Reveal Dimension: 1/2-inch.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 1. All Surfaces: VGS, unless noted otherwise.
 2. Apply BKL laminate to concealed surfaces.
 3. Edge Treatment: Same as laminate cladding on horizontal surfaces.

- D. Materials for Semiexposed Surfaces: Provide high-pressure decorative laminate, Grade CLS.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

2.7 PLASTIC-LAMINATE COUNTERTOPS

- A. High-Pressure Decorative Laminate Grade: HGS.
 - 1. Colors, Patterns, and Finishes: Provide Architect's selections from manufacturer's full range of standard colors.
- B. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- C. Core Material: Particleboard made with exterior glue.

2.8 FINISHING

- A. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate or backing paper.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8-inch in 96-inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
- 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 trim head fastening; countersink and fill void flush with woodwork using putty that matches 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. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten casework through back, near top and bottom, beginning at ends and not more than 16-inches o.c.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16-inches o.c. and to walls with adhesive.
 - 3. Seal space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants." Scribe supplementary top to top of backsplash if wall curvature causes gaps to be in excess of 1/4-inch behind backsplashes.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064020

SECTION 064600 - WOOD 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. Section Includes:
 - 1. Interior standing and running trim.
 - 2. Shop priming of wood trim.
- B. Refer to DWGS A842 and A843.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
 - 1. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.5 FIELD CONDITIONS

- A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Premium.
- B. Wood Species: Plain Sliced White Oak.

2.3 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 - 2. Edges of Rails and Similar Members More Than 3/4-Inch-Thick: 1/8 inch.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

2.4 SHOP PRIMING

- A. Interior Wood Trim for Finish: Wood stain specified in Section 099123 "Interior Painting."
- B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
 - 1. Back priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install wood trim to comply with same grade as item to be installed.
- B. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.
- B. Clean wood trim on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600

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SECTION 070543 – CLADDING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Engineered, tested, thermally-broken, aluminum rainscreen framing assembly at exterior cavity walls.
- B. Related Requirements
 - 1. Section 074213.23 – Metal-Composite-Material Wall Panels
 - 2. Section 076200 - Sheet Metal Flashing and Trim
 - 3. Section 079200 - Joint Sealants

1.3 REFERENCES

- A. ASTM International (ASTM)
 - 1. ASTM C954: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
 - 2. ASTM C1513: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
- B. International Code Commission (ICC) Evaluation Services:
 - 1. ICC ES AC193: Acceptance Criteria for Mechanical Anchors in Concrete Elements
 - 2. ICC ES AC261: Acceptance Criteria for Connectors used with Cold-Formed Steel Structural Members
 - 3. ICC ES AC308: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Arrange in conformance to requirements of Division 01.
 - 1. Attendance: Contractor installer, Owner, Architect, manufacturer's engineer providing curtain wall systems design, manufacturer's technical representative, and those representing related work requested to attend.

2. Meeting Time: Minimum 2 weeks prior to prior to beginning work of this Section and work of related Sections affecting work of this Section.
3. Location: Project Site.

- B. Sequencing and Scheduling: Conform to Construction Progress Schedule for Critical Path and scheduling for long lead items and to avoid delaying work.

1.5 SUBMITTALS

A. Product Data:

1. Descriptive product literature describing assembly design, performance, and characteristics.
2. Thermal analysis report indicating assembly U-values for the exterior framing system.
3. Metal finishes, accessories, and components.

B. Shop Drawings:

1. Plans, elevations, framed openings, bearing, details, thermal isolation, fasteners, connectors and anchorage devices, and attachments as needed for project execution.
2. Interface of aluminum assembly with adjacent construction.
3. Stamped and signed by licensed professional engineer, registered with the Commonwealth of Pennsylvania.

C. Samples: Two each of components and fasters for system assembly.

D. Design Calculations:

1. Comprehensive analysis of design loads, including dead loads, live loads, wind loads, and thermal movement.
2. Design shall be sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania.
3. Test Data: Independent test results or engineered analysis for performance signed by independent agency representative.

E. Manufacturer's Instructions: Include installation instructions, clearances, special procedures, and conditions requiring special attention.

F. Good Standing: Written and signed by manufacturer's agent indicating installer as in good standing and approved to erect work of this Section.

G. Sample Warranty: Meet or exceed provisions specified by this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Able to document minimum 5 years of experience designing and supplying work of this Section.
2. Maintain locally available technical product representation available to meet at project site as needed for meetings and inspections of work.

B. Installer Qualifications:

1. Trained and authorized by manufacturer as qualified to install work of this Section.
2. Employ full-time on-site superintendent or foreman to overseeing installation during work of this Section.
3. Able to show successfully completed projects of equivalent scope and quality upon request by Architect.

C. Mock-Ups: Provide under Quality Assurance provisions of Division 01.

1. Mock up complete system at location as directed by Architect.
2. Provide as required to illustrate substrate, air barrier, insulation, framing, flashing, thermal isolation, and treatments at fenestrations, corners, and transitions.
3. Verify mock-up as conforming to manufacturer's instructions and provisions of Contract Documents.
4. Do not begin work of this Section until after inspection by manufacturer's representative is complete and mock-up has been accepted in writing by Architect.
5. Protect and maintain accepted mock-up as standard of quality for work of this Section.
6. Accepted mock-ups may be incorporated into the work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Conform to provisions of Division 01 and manufacturer's instructions.
- B. Ordering: Conform to manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Store and handle to keep clean, dry, and protected from damage due to weather and construction activities.

1.8 FIELD CONDITIONS

- A. Site Environmental Requirements: Do not install materials until site conditions conform to manufacturer instructions.

1.9 WARRANTY

- A. Conform to Warranty requirements specified by Division 01.

- B. Manufacturer: 15-year materials warranty covering defective materials of extruded aluminum framing system.

1.10 SOURCE QUALITY CONTROL

- A. Single Source Responsibility: Furnish engineered design and fabrication by or under direct responsibility of single manufacturer.
- B. Field Measurements:
 - 1. Verify conditions prior to preparing shop drawings and beginning fabrications.
 - 2. Where this is not practical, verify with dimensions shown on shop drawings and mark corrections prior to installation.

PART 2 - EXECUTION

2.1 MANUFACTURERS

- A. Standard: Nvelope, NV1-System (Vertical/Exposed Fastener) Series Rainscreen System, thermally insulated and isolated between metal components and substrate, specified as basis of design.
- B. Quality Standard: NH2-System (Horizontal/Exposed Fastener) Series Rainscreen System, thermally insulated and isolated between metal components and substrate.
- C. Other Acceptable Manufacturers: Knight Wall Systems

2.2 REGULATORY REQUIREMENTS

- A. Design and Structural Properties: Conform to provisions of 2009 International Building Code (IBC) including IBC Section 1604.3.3 and IBC-2009 Section 2211 including applicable referenced AISI specifications and standards, including following as applicable.
 - 1. AISI S100.
 - 2. AISI S200.
 - 3. AISI S211.
 - 4. AISI S212.
 - 5. AISI S213.

2.3 PERFORMANCE / DESIGN CRITERIA

- A. Structural Design: Provide engineered design capable of withstanding combined effects of stresses from dead loads, wind loads, normal thermal movement, and other anticipated stresses without evidence of permanent defects or failure.
 - 1. Wind Load: Uniform pressure (velocity pressure) as indicated on Structural Drawings, acting inward or outward.

2. Dead Loads: Design for loading to accommodate support of cladding systems specified by related sections and shown on Drawings and as required by applicable building code.
 3. Seismic Loads: Design and size components to withstand seismic loads and sway displacement.
- B. Thermal Expansion and Contraction: Design for movement due to cyclic day and night temperatures to not exceed safety factors for fasteners, joints, seals, and components.
- C. Cladding Accommodation: Design framing support assembly to maintain dimensions to face of cladding materials indicated on Drawings. Design framing supports configuration, size, spacing, and make adjustments as needed to accommodate support for each cladding type specified and referenced as part of Related Requirements.
- D. Rain Screen Design: Design ventilating system assembly to accommodate movement of air movement into the rain screen cavity and move water vapor out.
- E. Tolerances:
1. Accommodate deflection of structural members.
 2. Maintain clearances at adjacent construction.
 3. Prevent load transfer to non-structural elements.
- F. Thermal Barriers:
1. Thermally isolate metal components from each other and support wall.
 - a. Maximum contact area between isolator and sheathing: 3.15 square inches
 - b. Maximum thickness: 0.375 inches
 - c. Shims that may be used for plumb and true alignments must not increase thermal isolation contact area.
 2. Thermally isolate fasteners from metal using thermal isolation washers or other means.
 - a. Minimum thickness: 0.125 inches
- G. Thermal Insulation: As specified by Section 072100, Thermal Insulation.
1. Design thickness and type of insulation into system assembly.
 2. Perform thermal analysis to determine framing systems effect on wall assembly.
- H. Effect on Wall Assemblies Thermal Resistance: Framing system must not degrade complete wall assemblies thermal resistance by more than 17 percent and conform to ASHRAE 90.1 prescriptive U-value of wall assembly for appropriate climate zone.
1. Three dimensional computer simulated thermal analysis or guarded hot-box test (ASTM C1363-11) results required.

2.4 EXTRUDED ALUMINUM SUB-FRAMING:

- A. Gauge, Configuration, Dimensions, and Spacing: Minimum gauge and as required to conform to design criteria for each assembly.

Material: Alloy - 6005A T6 appropriate for rainscreen cladding support / construction

B. Wall Brackets:

1. Single brackets have a height of 75 mm and the double brackets, 150 mm Pre-Punched Holes: For minimum two wall anchors per bracket.
2. Stem for Connecting Rail to Bracket: Must not penetrate exterior layer of insulation.
 - a. Small bracket dimensions: 3 inch (h) and 2.5 inch (w). Plate thickness of 6.5mm for steel and wood frame, 11mm for concrete or CMU substrate.
 - b. Large bracket dimensions: 6 inch (h) and 2.5 inch (w). Plate thickness of 6.5mm for steel and wood frame, 11mm for concrete or CMU substrate.
 - c. Pre-punched Holes: For easy engagement and placement of stainless steel self-tapping hex-head screws for use in attaching vertical rail.
3. Dimensions: As needed to offset cladding from wall plane where meeting substrate and to allow for installation of insulation equal in thickness to offset.
 - a. Offset Brackets – 40mm,60mm,90mm,120mm,150mm, 180mm,210mm, 240mm,270mm,300mm depths with up to 40mm of adjustment on the vertical axis.
 - b. Align offsets to differing wall planes as shown on Drawings.
4. Recommended Product: SFS (Nvelope) Thermal Isolator (color: green)

C. Vertical Rail: Minimum 2.2mm thick extruded aluminum

1. Profile: L rail for vertical furring members.
2. Nominal Dimensions: 60mm leg and 40mm leg
3. Profile: T-section for vertical furring members.
4. Nominal Dimensions: (T60-80) 60mm leg and 80mm face. (T60-100) 60mm leg and 100mm face. (T40-100) 40mm leg and 100mm face. (T60-120) 60mm leg and 120mm face. (T60-140) 60mm leg and 140mm face.
5. Profile: U-Section: (HBL60-40) 60mm leg and 40mm face. 2.5 mm thickness.
6. Profile: Z-Section: (Z25-45-30) 25mm face and 45mm leg and 30mm face. (Z40-45-55) 40mm face and 45mm leg and 55mm face. 2.4 mm thickness.

D. Horizontal Rail (NV3 only): Nominal 2.5mm thick extruded aluminum

1. Profile: (CP-NV3-3000) Horizontal Rail
2. Dimensions: 60mm (h) and 25mm (depth). Intermittent cleat fixed to cladding panel are mate to horizontal rail. When engaged, total depth is 26mm.
3. Attachment Holes: Cleats are factory-punched to accommodate fastener spacing and dimension.
4. Oversize holes to allow for thermal contraction and expansion of rail.

2.5 THERMAL BARRIER

- A. Material: Injection molded Polypropylene copolymer.

- B. Size: To accommodate plate
- C. Recommended Product: Nvelope N.
 - 1. Framing member to framing member isolation: minimum 0.125 inch thick
 - 2. Isolator must match support bracket and must not decrease structural performance of system.
- D. V-T1 or NVT2 Thermal Isolators by SFS or approved equivalent, or recommended by system manufacturer.

2.6 CONNECTORS AND ANCHORS

- A. Connectors used with Cold-Formed Steel Framing Members: Conform to ICC ES AC261
- B. Screw Fasteners: Stainless steel as instructed by manufacturer.
 - 1. Thermoset Polyester coating that exhibits 1,000 hours of salt spray beyond stainless steel anti-corrosiveness.
 - a. Minimum No. 14 self-drill hex-head screw fastener to be used to attach horizontal rail to vertical rail.
 - b. Steel Studs:
 - c. Self-drill hex-head TEK screw fasteners of sufficient length
 - d. Minimum three threads must penetrate steel stud members.
- C. Concrete and Masonry Wall Anchors: Mechanical and Adhesive anchors, bolts, nuts, and washers suited to use and as required for transference of design loads.
 - 1. Mechanical Anchors: Expansion type, conforming to ICC ES AC193.
 - a. Adhesive Anchors: Torque Controlled, conforming to ICC ES AC308

2.7 ACCESSORIES

- A. Bracing, Furring, Bridging, Plates, Gussets, and Clips: Formed sheet steel or fiberglass, thickness as necessary to meet structural requirements for special conditions encountered.
- B. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions ready to receive work of this Section before beginning.
- B. Backup Wall: Verify level and plumb, free of defects, and conforming to tolerances suitable for installation of subsequent work.

- C. Weather Resistive Barrier: Verify complete, cured, and conforming to manufacturer's instructions. Verify fenestrations, transitions, discontinuities, and sills and ledgers flashed and sealed to move moisture to exterior of building as part of air barrier system.

3.2 PREPARATION

- A. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
- B. Adjust and perform work as necessary for plumb and true alignments.

3.3 INSTALLATION

- A. Conform to manufacturer's instructions and provisions of Contract Documents.
- B. Erect cold-formed rain screen assembly to be level, plumb, and in alignment with building features including corners, off-sets, and fenestrations.
- C. Wall Brackets and Vertical Rail:
 - 1. Mount wall brackets at 16 inch on center horizontally on support wall (at each stud location), using self-drilling self-tapping screws at metal stud framed walls and expansion or adhesive anchors at concrete and masonry walls.
 - a. Lay brackets out at an even 0.5 inch increment vertically or horizontally.
 - b. Tighten snug tight, approximately 90 in/lbs of torque, and as instructed by fastener manufacturer instructions.
 - c. Where using snug tight criteria, verify torque for each installer using hand tools at beginning of project.
 - 1) Thermally isolate wall bracket attachments by sandwiching thermal break material between metal bracket and support wall substrate.
 - 2) Isolate screw fastener washers using material to thermally isolate fastener heads from metal bracket.
 - 3) Attach horizontal rail to wall bracket stem by use of a self-tapping screw fastener through the pre-punched holes in the rail and into the pre-punched pilot holes on the bracket.
 - 4) Isolate horizontal rail from bracket by sandwiching a thermal break material between rail and bracket stem.
 - 5) Place shims the same size and profile as the isolator between the sheathing and bracket isolator to account for irregularities in support wall.
 - 6) Establish and re-establish and restart vertical bracket locations using laser or chalk-line at fenestrations and other obstructions to establish horizontal alignments. Brackets must be placed at 0.5 inch increments vertically or horizontally.
- D. Horizontal Rail:
 - 1. Space to make suitable bearing surfaces for each cladding system as instructed by manufacturer and as shown on Architect accepted shop drawings.
 - a. Begin at bottom and mount to vertical rails using No. 14 self-drilling self-tapping stainless steel screws.

- b. Tighten screws to snug tight, typically between 90-95 in/lbs of torque. Verify equivalent snug tight condition for installers using hand tools.
 - c. Install successive horizontal rails as required for panel type.
 - d. When encountering fenestrations and other openings, mount horizontal rails so that fastening points are as close to the lower and upper edges as possible.
- E. Semi-Rigid Mineral Wool Insulation: Install to expand into and tightly fit between wall brackets to make continuous, unbroken insulated face of wall as specified by Section 072116.
- F. Touch-up shop-applied protective coatings damaged during handling and installation.
- G. Use shearing instruments (i.e. snips, nibbler, etc.) for cutting metal framing components. Saws are not recommended, as the sparks produced during cutting will damage the anti-corrosion coating. If saws are used, surrounded metal coating MUST be protected from sparks.
- H. Cut installed vertical rails to minimum 12 inch lengths and mechanically attach to at least two separate wall brackets.
- I. Cut installed horizontal rails to minimum 12 inch lengths and mechanically attach to at least two separate vertical rails to prevent rotation of rail.
 - 1. At unsupported span of installed horizontal rails that extend past closest vertical rails, do not exceed 7.5 inch in length for 16 inch on center spaced studs or 11.5 inch in length for 24 inch on center spaced studs.
 - a. At opening jambs (i.e. windows, doors, and other fenestrations) do not extend the horizontal rails past vertical rails by more than 3 inch in length.

3.4 ERECTION TOLERANCES

- A. Maximum Framing Member Variation from True Position: 1/8 inch.
- B. Maximum Framing Member Variation from Plane:
 - 1. Individual Framing Members: Do not exceed 1/8 inch in 10 foot.
 - a. Accumulative Over-all Variation for Wall and Floor System: Do not exceed 1/8 inch.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Technical Service: Make intermittent and final inspection to verify installation in conformance to manufacturer instructions and suitable as framing assembly for subsequent metal panels, acrylic plastering, and other cladding installations.
 - 1. Confirm snug tight and fastener sizing.
 - a. Confirm framing members installed in correct orientation.

3.6 ADJUSTING

- A. Inspect and adjust after installation. Replace or repair defective work.
- B. Adjust, and reconfigure as necessary to accommodate cladding systems for installations over work of this Section. Do not reuse pre-drilled holes unless fastener size is increased.

END OF SECTION 070543

SECTION 070553 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. North Carolina State Building Code – Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.05 FIELD CONDITIONS

- A. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

- A. See Section 099123 for substrate preparation for painted markings.

3.03 INSTALLATION

- A. Locate markings as required by governing codes and authorities.
- B. Install neatly, with horizontal edges level.

- C. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION 070553

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Drainage panels.

1.2 RELATED REQUIREMENTS

- A. Section 311505 - Excavation, Backfill, and Compaction.

1.3 REFERENCE STANDARDS

- A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
- B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
 - 2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
 - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
 - 4. Applied Thickness: 1/16-inch, minimum, wet film.
 - 5. Products:
 - a. W. R. Meadows, Inc; Sealastic Emulsion Type I (spray-grade): www.wrmeadows.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.2 ACCESSORIES

- A. Drainage Panel: 1/4-inch-thick formed plastic, hollowed sandwich.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

- A. Apply bitumen with mop.
- B. Seal items watertight with mastic, that project through dampproofing surface.
- C. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.
- D. Place protection board over drainage panel, butt joints, and adhere with mastic.
- E. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION 071113

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SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing to be installed around recessed concrete slab.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.
 - 2. 8-by-8-inch square of insulation.
 - 3. 4-by-4-inch square of drainage panel.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.

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. American Hydrotech, Inc; VM75.
 - b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - c. CETCO Building Materials Group, a subsidiary of AMCOL International Corp; Envirosheet.
 - d. Grace Construction Products; W.R. Grace & Co. -- Conn; Bituthene 4000.
 - e. Henry Company; Blueskin WP 100/200.
 - f. Meadows, W.R., Inc; SealTight Mel-Rol.
 - g. Protecto Wrap Company; PW 100/60.
2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F ; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE 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. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints or expansion joints discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet-waterproofing terminations with mastic.
- F. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

3.4 FIELD QUALITY CONTROL

- A. Owner will engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 072100 - THERMAL 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. Section Includes:
 - 1. Foam-plastic board insulation.
 - 2. Rigid mineral wool board insulation.
 - 3. Batt insulation.
 - 4. Spray polyurethane foam insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
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. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products.
 2. Type IV, 25 psi. at perimeter foundation walls.
 3. Type V, 100 psi. under slab.
 4. White-faced exterior layer at curtain wall spandrel locations.
 5. Roof insulation: Reference specification section 075419, PVC Roofing.

2.2 RIGID MINERAL WOOL INSULATION SHEATHING BOARD

- A. Rigid Mineral Wool Insulation Sheathing Board: ASTM C423, ASTM C165, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
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: Rockwool CAVITYROCK or equivalent product from: Owens Corning, Johns Manville.
 2. Refer to Drawings for insulation thicknesses and thermal resistance rating.

2.3 BATT INSULATION

- A. Semi-Rigid batt insulation: ASTM C167, ASTM C518, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 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: Rockwool COMFORT BATT or equivalent product from: Owens Corning, Johns Manville.
 - 2. Refer to Drawings for insulation thicknesses and thermal resistance rating.

2.4 ACOUSTIC BATT INSULATION

- A. Semi-Rigid batt insulation: ASTM C423, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 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: Rockwool AFB or equivalent product from: Owens Corning, Johns Manville.
 - 2. Refer to Drawings for insulation thicknesses and thermal resistance rating.

2.5 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide CertainTeed Corp.; CertaSpray Closed Cell Foam, or comparable product by one of the following:
 - a. BASF Corporation.
 - b. BaySystems NorthAmerica, LLC.
 - c. Dow Chemical Company (The).
 - d. ERSystems, Inc.
 - e. Gaco Western Inc.
 - f. Henry Company.
 - g. Lapolla Industries
 - h. NCFI; Division of Barnhardt Mfg. Co.
 - i. SWD Urethane Company.
 - j. Volatile Free, Inc.
 - 2. Physical and Mechanical Properties:
 - a. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
 - b. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft2- degrees F)/Btu.

- c. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft²- degrees F)/Btu.
- d. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
- e. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
- f. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
- g. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
- h. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Day.
- i. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
- j. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m².
- k. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.

2.6 INSULATION FASTENERS

- A. Type recommended by insulation manufacturer for insulation types, and applications specified.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.2 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.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive applied according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, 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 24 inches below exterior grade line.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Semi-rigid mineral wool insulation sheathing board: Install as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 4 Section "Unit Masonry Assemblies."

3.5 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. Semi-rigid batt 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 and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied,

make flush with face of studs by using method recommended by insulation manufacturer.

3.6 INSTALLATION OF INSULATION FOR CONCRETE/CMU (NON-CAVITY) SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten z-clip to concrete or cmu substrates where exterior cladding is cement board, metal panel or as noted in drawings per manufacturer's written instructions. Space clips according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation (with white face toward exterior) in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Fasten 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 between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.8 PROTECTION

A. Protect installed insulation 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 072100

SECTION 072500 – VAPOR RETARDERS

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. Under slab vapor retarders.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
 - 2. For vapor retarders, include data indicating material characteristics, performance criteria, and limitations.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.
- B. Manufacturer's Installation Instructions: Submit preparation and installation requirements, techniques.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS - UNDER-SLAB

- A. Vapor Retarder Permeance: Maximum 0.1 perm perms when tested in accordance with ASTM E96, Procedure A.
- B. Manufacturers:
 - 1. Reef Industries; Griffolyn 15
 - 2. Raven Industries; Vapor Block 15.
 - 3. Stego Industries; Stego Wrap.
 - 4. Fortifiber Corporation; Moistop Ultra 15.

- C. Sheet Vapor Retarder: ASTM E1745, Class A, 0.015 inches thick geomembrane for used for under-slab application.
 - 1. Water Vapor Permeance: Maximum 0.030 perm inch.
- D. Tape: Pressure sensitive, type to suit membrane, minimum 4 inches wide.

PART 3 - EXECUTION

3.1 UNDER-SLAB INSTALLATION

- A. Install in accordance with manufacturer's instructions and ASTM E1643.
- B. Unroll with longest dimension parallel with the direction of the pour.
- C. Lap over footings and seal to foundation walls.
- D. Lap joints a minimum of six inches and seal with tape.
- E. Seal penetrations with pipe boots made from membrane material and tape.
- F. Repair damaged areas by cutting patches of membrane, overlapping damaged areas a minimum of six inches and taping all four sides with membrane tape.

END OF SECTION 072500

SECTION 072715 – NON BITUMINOUS SELF-ADHERING SHEET AIR BARRIERS

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. Self-adhering, vapor-permeable, non-bituminous sheet air barriers to be used at all cold formed metal stud partitions with exterior sheathing.
- B. Related Requirements:
 - 1. Division 06 Section "Sheathing" for wall sheathings and wall sheathing joint and penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
 - 2. Meet with Owner, Architect, inspecting representative, Air-Barrier Installer, Air-Barrier system manufacturer's technical representative (sales representative not acceptable), exterior sheathing Installer, exterior cladding Installer, window/curtainwall Installer, and installers whose work interfaces with or affects

the Air-Barrier system, including installers of any equipment that may penetrate the Air-Barrier system.

3. Review methods and procedures related to Air-Barrier installation, including manufacturer's written instructions.
4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review substrate requirements for conditions and finishes, including flatness and fastening.
6. Review transitions with below grade waterproofing, roof system, special details, flashings, penetrations, and condition of other construction that affects the Air-Barrier roofing system.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review inspection schedule and repair procedures prior to application of cladding.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

Basis of Design Product: Subject to compliance with requirements, provide WR Meadows, Air Shield SMP or approved equivalent.

1. Henry Company, VP 160
2. GCP, Perm-A-Barrier VPS

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous 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, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 NON-BITUMINOUS SHEET AIR BARRIER

- A. Vapor-Permeable Non-bituminous Sheet: Minimum 26-mil thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side.
 1. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Puncture Resistance: Minimum 40 lbf; ASTM E 154/E 154M.
 - c. Water Vapor Permeance: 1658 ng/Pa.m².s (minimum 29 perms) to ASTM E96, Method B – Desiccant Method.
 - d. Tested to ASTM E 2357 for Air Leakage of Air Barrier Assemblies.
 - e. Resistance to Water Penetration: Pass ICC-ES AC 38.
 - f. Water Penetration Resistance around Nails: Pass when tested to AAMA 711-05 & ASTM D 1970 modified.
 - g. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84: Flame Spread and Smoke Development Class A.
 - h. Tensile Strength: 50lbf/in (5.64N/m) MD, 30lbf/in (3.39 N/m) XD, ASTM D882
 - i. Low Temperature Flexibility: Pass, AC 38

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic,

substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- G. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 INSTALLATION

- A. Install materials according to air-barrier manufacturer's most current written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Apply primer to all substrates at required rate and allow it to dry.
- B. Prepare, treat, and seal inside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic.
- C. Apply primer to all substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Re-prime areas exposed for more than 24 hours.
- D. Apply primer to all dissimilar materials within air barrier system, i.e. prime sheet membrane in preparation for detail membrane, prime detail membrane in preparation for sheet membrane, etc.
- E. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water.
 - 2. Overlap horizontally (side laps) adjacent sheets a minimum of 2 inches and roll seams. Apply termination mastic and lightly tool at all seams.
 - 3. Overlap vertically (end laps) adjacent sheets a minimum of 5 inches and roll seams. Apply termination mastic and lightly tool at all seams.
 - 4. Roll sheets firmly to enhance adhesion to substrate.
- F. Apply termination mastic at all seams in sheet membrane and detail membrane factory edge or cut edge. Lightly tool all mastic.
- G. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.
- H. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch wide, transition strip.
- I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counter-flashings or ending in reglets with termination mastic.
- J. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

- K. Connect and seal exterior wall air-barrier sheet 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.
- L. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- M. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions. Apply termination mastic around entire perimeter.
- N. Do not cover air barrier until it has been reviewed by Design Team.
- O. 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. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections, minimum of five visits during the execution not including the Preinstallation Conference, to be performed by manufacturer's Technical personnel. Manufacturer's representatives are not acceptable.
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Substrate surfaces have been primed.
 - 7. All surfaces of dissimilar materials within the air barrier system have been primed.
 - 8. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on seams and cut edges.
 - 10. Air barrier has been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.

3.5 CLEANING AND 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 recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 072715

SECTION 072726 - LIQUID APPLIED VAPOR PERMEABLE AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied air barrier to be used at concrete masonry unit walls where air barrier is required.
- B. Surface preparation.
- C. Application of liquid-applied vapor permeable air barrier.
- D. Application of materials to provide bridge and seal air leakage pathways in
 - 1. Wall and roof connections and penetrations.
 - 2. Connections to foundation walls.
 - 3. Walls, windows, curtain walls, storefronts, louvers, or doors
 - 4. Expansion and control joints.
 - 5. Masonry ties.
 - 6. All other penetrations through the wall assembly.

1.02 RELATED SECTIONS

- A. Section 04 20 00 - Unit Masonry.
- B. Section 07 21 00 - Thermal Insulation.
- C. Section 07 50 00 - Membrane Roofing.
- D. Section 07 60 00 - Flashing and Sheet Metal.
- E. Section 07 70 00 - Roof and Wall Specialties and Accessories.
- F. Section 07 80 00 - Fire and Smoke Protection.
- G. Section 07 92 00 - Joint Sealants.
- H. Section 08 10 00 - Doors and Frames.
- I. Section 08 50 00 - Windows.
- J. Section 09 20 00 - Plaster and Gypsum Board.

1.03 REFERENCES

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
- G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
- H. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.04 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Air Barrier Installer shall be currently accredited under the Air Barrier Association of America and ensure applicators are certified in accordance with the ABAA Quality Assurance Program.
 - 2. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.
 - a. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.
- B. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 PRECONSTRUCTION MEETING

- A. Preconstruction Meeting: Conduct meeting prior to commencing Work of this section.

1.07 MOCK-UPS

- A. Prior to installation of air barrier, apply air barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution.
- B. Apply air barrier in field-constructed mock-ups of assemblies specified in Section 042000 – Unit Masonry.
- C. Apply air barrier in field-constructed mock-ups of assemblies as shown in drawings.
- D. Reference drawings for mock-up detail.
- E. Test mock-up in accordance with ASTM E783 and ASTM E1105 for air and water infiltration.
- F. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air barrier membrane unless it has been inspected, tested, and approved.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean dry area in accordance with manufacturer's instructions.
- C. Store at temperatures at or above 40° F (4° C), free from contact with cold or frozen surfaces.
- D. Protect materials during handling and application to prevent damage or contamination.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Do not proceed with product application if rainfall is forecast or imminent within 12 hours.
- C. Do not apply membrane when air or surface temperatures are below 20° F (-6.7° C).
- D. Do not apply when air, material and surface temperatures are expected to fall below 20° F (-6.7° C) within 24 hours of completed application.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

- B. Basis of Design Product: Subject to compliance with requirements, provide WR Meadows, Air Shield SMP or approved equivalent.

1. Henry Company
2. GCP

2.02 MATERIALS

- A. Liquid Air Barrier System: One component, polymer modified, cold applied liquid vapor permeable air barrier membrane.
1. Performance Based Specification: Air barrier membrane shall be water-based, that cures to form a tough, seamless, elastomeric membrane having the following characteristics:
 - a. Air Leakage ASTM E2357: < 0.04 cfm / ft.² @ 75 Pa (1.57 lb./ft.²).
 - b. Air Permeability ASTM E2178: < 0.004 cfm/ft.² @ 75 Pa (1.57 lb./ft.²).
 - c. Water Vapor Permeance ASTM E96 Method B: > 10 perms.
 - d. Elongation ASTM D412: 1300%.
 - e. Flexibility at -20° C ASTM C836 2" mandrel: Pass.
 - f. Flame Spread and Smoke Development, ASTM E84: Class A.
 2. Proprietary Based Specification: AIR-SHIELD LMP by W. R. MEADOWS.

2.03 ACCESSORIES

- A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).
1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.
- B. Joint Sealant: Single component, polyurethane joint sealant for exterior sheathing panels.
1. POURTHANE® NS by W. R. MEADOWS.
- C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings and detailing.
1. AIR-SHIELD LIQUID FLASHING by W. R. MEADOWS.
- D. Joint Tape: Self-adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).
1. AIR-SHIELD by W. R. MEADOWS.
- E. Membrane Adhesive:
1. Temperatures above 40° F (4° C): Water-Based Adhesive
 - a. MEL-PRIME™ W/B Water-Based Adhesive by W. R. MEADOWS.
 2. Temperatures below 30° F (-1° C): Solvent-Based Primer.
 - a. MEL-PRIME VOC Compliant Solvent-Base Adhesive or Standard Solvent-Base Adhesive by W. R. MEADOWS.

- F. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
 - 1. POINTING MASTIC by W. R. MEADOWS.
- G. Detailing Membrane: non-slump waterproofing material for joint detailing.
 - 1. BEM by W. R. MEADOWS.
- H. Concrete Repair Materials: general purpose patching materials.
 - 1. MEADOW-PATCH™ 5 and MEADOW-PATCH 20 Concrete Repair Mortars by W. R. MEADOWS.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive air barrier.
- B. Clean and prepare surfaces to receive air barrier membrane in accordance with manufacturer's instructions.
- C. Do not apply membrane to surfaces unacceptable to manufacturer.
- D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds, or any other foreign material that could prevent proper adhesion of the membrane.
- E. Patch all holes and voids and smooth out any surface misalignments.
- F. Patch all cracks, protrusions, small voids, offsets, details, irregularities, and small deformities with cementitious patching mortar at least two hours before application.
- G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

3.03 APPLICATION OF AIR BARRIER SYSTEM

- A. Transition Membrane
 - 1. Prime surfaces to be covered in one working day with applicable primer.
 - 2. Apply transition membrane with a minimum overlap of 3" (75 mm) onto primed surface at all joints, columns, beams, and dissimilar materials.
 - 3. Roll membrane firmly into place.
 - 4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.

5. Overlap subsequent courses of membrane a minimum of 2" (50 mm) and ensure joints are fully adhered.
 6. Seal top edge of transition membrane with pointing mastic.
- B. Rough Opening Transition Membrane
1. Self-adhesive Transition Membrane.
 - a. Prime the area to be detailed using adhesive recommended by the membrane manufacturer according to the substrate.
 - b. Pre-cut the self-adhesive membrane for each area of the rough opening to ensure ease of handling.
 - c. Apply the first pre-cut strip at the base of the rough opening by removing the release paper and rolling firmly into place, ensuring that there is a minimum of 3" (75 mm) of membrane extending onto the wall and a minimum of 3" (75 mm) of membrane extending into the rough opening.
 - d. Repeat this procedure for the vertical areas of the rough opening and the header portion of the opening.
 - e. Ensure all edge overlaps are a minimum of 2" (50 mm) and end to end overlaps are 4" (100 mm).
 - f. Seal all terminations with mastic recommended by membrane manufacturer.
 2. Fluid Applied Transition Membrane using vapor permeable membrane
 - a. Apply a coat of primer on the raw edges of exterior gypsum board.
 - b. Apply a minimum of 30 wet mil coat of the air barrier membrane extending a minimum of 3" (75 mm) onto the wall.
 - c. Apply a minimum of 30 wet mil coat of the air barrier membrane extending into the rough opening a minimum of 3" (75 mm).
 - d. Embed a layer of 6" (150 mm) reinforcing fabric into this first coat.
 - e. Completely cover the glass mesh with a second coat of the air barrier membrane at 30 wet mils while the first coat is still wet, again extending 3" (75 mm) onto the wall and 3" (75 mm) into the rough opening.
 - f. Follow this same procedure for concrete or concrete masonry without using the mesh tape ensuring a 60 wet mil thickness is achieved.
 3. Fluid Applied Transition Membrane using liquid flashing membrane
 - a. Apply a coat of primer on the raw edges of exterior gypsum board.
 - b. Treatment of joints or cracks larger than 1/4" (6.35 mm) and less than 1/2" (12.7 mm).
 - i. Prefill any joints or cracks with the liquid flashing material.
 - ii. Apply a generous bead of material over the joint.
 - iii. Press and spread liquid flashing into the joint.
 - iv. Allow material to skin over prior to full application of liquid flashing the rough opening.

- c. Treatment of joints or cracks larger than ½" (12.7 mm)
 - i. Install backer rod into the joint to control depth of liquid flashing material.
 - ii. Apply a generous bead of material over and into the joint.
 - iii. Press and spread liquid flashing into the joint.
 - iv. Smooth out using a spreader tool or putty knife
 - v. Allow material to cure prior to full application of liquid flashing into the rough opening.
 - d. Apply a bead of liquid flashing in the rough opening starting at the top and continuing around the rough opening.
 - e. Spread the material using a spreader tool or putty knife across the rough opening surface.
 - f. Test the material thickness using a wet mil gauge to ensure that it has a thickness of 12 - 15 mils.
 - g. Apply a generous bead of liquid flashing material to the vertical surface around the rough opening and spread this material 4" - 6" (100 - 152 mm) onto the vertical surface with a spreader tool or putty knife.
 - h. Test the thickness to ensure the material has a thickness of 12 – 15 mils.
 - i. Allow liquid flashing material to dry before installing any windows, doors, wall assembly, and full air barrier material.
- C. Through Wall Flashing
- 1. Prime surfaces to be covered in one working day with applicable adhesive.
 - 2. Remove release paper prior to application.
 - 3. Apply through wall flashing at based of masonry walls as indicated on drawings.
 - 4. Recess through wall flashing 1/2" (13 mm) from the face of the masonry.
 - 5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.
- D. Air Barrier Membrane
- 1. Apply air barrier membrane in accordance with manufacturer's instructions.
 - 2. Thoroughly mechanically mix membrane prior to application.
 - 3. Apply membrane by spray or roller at a minimum coverage rate of 25 ft.²/U.S. gal (0.61 m²/L) providing a thickness of 60 wet mils in two coats.
 - 4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
 - 5. Work material into any fluted rib forming indentations.
 - 6. Cured thickness of membrane should be 30 mils dry.
 - 7. Allow 48 hours for full cure of the membrane.

3.04 PROTECTION

- A. Cover air barrier membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION 072726

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

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 Metal Composite Material Wall Panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
 - 8. Review procedures for repair of panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build 4 ft. x 4 ft. mockup of typical metal composite material panel assembly as shown on Drawings, including corner, soffits, supports, attachments, and accessories.
 2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/175 of the span.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. 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 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for

installation method indicated. Include attachment assembly components, and accessories required for weathertight system.

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. 3A Composites USA, Inc.; Alucobond.
- b. Alcoa Inc.; Reynobond FR.
- c. AL13 Architectural Systems; Panel System.
- d. CENTRIA Architectural Systems; Formabond Wall System.
- e. Citadel Architectural Products, Inc.; Envelope 2000 RR.
- f. Firestone Metal Products, LLC; UNA-CLAD Series 1000UC.
- g. Protean Construction Products, Inc.; ACM 100.

- B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.

1. Panel Thickness: 6 mm.
2. Core: Standard.

- C. Attachment Assembly Components: Formed from extruded aluminum or material compatible with panel facing.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: As specified in section 07 05 43 "Cladding Support Systems." Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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 same piece are not acceptable. 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.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
 - a. Verify that Moisture Barrier has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
 - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal composite material panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions

cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.
- D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

SECTION 075330 - ACCESS FLOOR WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access Floor Waterproofing.

1.02 RELATED REQUIREMENTS

- A. Section 033000- Concrete.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for waterproof flooring beneath elevated access flooring specified herein.
 - 1. Samples: 1. Submit 2-1/2" x 4" samples.
- C. Material certificates signed by manufacturer certifying that the waterproof flooring complies with requirements specified herein.
- D. Maintenance Instructions: Submit manufacturer's written instruction for recommended maintenance practices.
- E. Contractor Certification: Submit a letter from the primary materials manufacturer certifying that the installing contractor has been properly trained in the application of the materials being install, is acceptable to the materials manufacturer , with a record of successful in-service performance.
 - 1. Engage an installer who employs only persons trained and approved by the resinous flooring manufacturer for applying resinous flooring systems specified.
 - 2. Engage an installer who is certified in writing by the resinous flooring manufacturer as a factory trained applicator qualified to apply the specified resinous flooring system.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer or applicator who has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.

- B. Single-Source Responsibility: Obtain waterproof flooring materials, including membrane, resins and finish coats, from a single manufacturer.
- C. Qualified Materials: Request for material approvals for any products other than the specified products must be submitted to the architect two weeks prior to the bid, including complete application specification, physical characteristics, and chemical resistance data. Any request after this date will not be accepted. Failure of performance requires immediate removal and replacement of unapproved substituted material with those originally specified at no cost to the owner, architect, construction manager, or general contractor.

1.05 MOCK-UP

- A. Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set the standard of quality for materials and installation.
 - 1. Apply all components of the specified resinous flooring system at the specified thickness and finished in the texture and color as selected. Apply a minimum 100 square feet area to simulate the actual installation characteristics. Include areas that demonstrate the finished cove base, joint detailing, terminations or any other special conditions.
 - 2. Simulate finished lighting conditions for Architects review of mockups.
 - 3. Approved mockups may become part of the completed work if undisturbed at the time of substantial completion.

1.06 DELIVERY STORAGE AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Basis of Design:
 - 1. Dex-O-Tex Access Floor Waterproofing as manufactured by Crossfield Products Corp. located in Rancho Dominguez, California and Roselle Park, New Jersey.

2.02 PROPERTIES

- A. Colors: As selected by Architect from manufacturer's standard colors.
- B. Physical Properties: Provide flooring system that meets or exceeds the listed minimum physical property requirements when tested according to the referenced standard test method.
 - 1. Membrane Component
 - a. Waterproofness
 - b. ASTM D751 (suspended sample; No moisture penetration subjected to 2' water head for 40 hours)
 - c. Puncture Resistance
 - d. Tensile Strength (ASTM D751) 288 psi
 - e. Elongation (ASTM D751) 158%
 - 2. Wear Course Component
 - a. Adhesion (ASTM C882, Type 1) 515 psi\
 - b. Shore Hardness (ASTM D2440) Durometer "A" -82
 - c. Impact Resistance (MIL-PRF-3134, Para. 4.7.3) No cracking or detachment
 - d. Flammability (ASTM E84)
 - 1) Flame Spread
 - 2) Smoke Density
 - 3. Combined System
 - a. Thickness 1/8" (118 mils/3.17mm)
 - b. Pedestal Adhesion Complies (1,228 in. – Procedures for Access
 - c. CISCA Recommended test Floors; lbs.) Sec. 6 Pedestal Overturning Moment Test

PART 3- EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions where waterproof flooring beneath elevated access flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.
- B. Moisture Test: Perform moisture test in conformance with ASTM F 1869 and ASTM F 2170

3.02 PREPARATION

- A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
- B. Concrete Surfaces: Shot-blast, or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminate. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.
- C. Materials: Mix materials and prepare materials according to flooring system manufacturer's instructions.

3.03 APPLICATION

- A. General: Apply each component of flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
- B. Cove Base: Apply cove base to wall surfaces at locations shown to form cove base height of 4 inches unless otherwise indicated. Apply polyurethane sealant at vertical to horizontal transition. Apply detail coat of fabric reinforced membrane. Install access floor membrane and wear course over previously installed detail coat. Follow manufacturer's printed instructions.
- C. Membrane Coat: Apply neoprene composition waterproof membrane to a nominal 25 mils of thickness by squeegee, trowel or spray.

- D. Wear Course: After membrane has cured sufficiently, apply wear course recommended by flooring manufacturer to produce finish matching approved sample and in number of coats and spreading rates recommended by manufacturer.

3.04 CURING, PROTECTION AND CLEANING

- A. Cure waterproof flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION

SECTION 075423.13 - REINFORCED ADHERED ROOFING SYSTEM OVER METAL DECK

PART 1 - GENERAL

The project Bertie County 911 Communications Center located in Windsor, NC, includes the provision of a complete Firestone Building Products: Firestone PVC Adhered Membrane Roofing System.

1.01 SUMMARY

- A. Furnish and install thermoplastic sheet roofing system, including:
 - 1. Roofing manufacturer's requirements for the specified warranty.
 - 2. Preparation of roofing substrates.
 - 3. Wood nailers for roofing attachment.
 - 4. Vapor barrier.
 - 5. Insulation.
 - 6. Cover boards.
 - 7. Thermoplastic membrane roofing.
 - 8. Metal roof edging and copings.
 - 9. Flashings.
 - 10. Walkway pads.
 - 11. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer at <https://www.firestonebpc.com>.
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.
- C. Section 07 71 00 - Roof Specialties: Manufactured copings, fascia's, gravel stops, and other flashing-related items.

- D. Section 07 72 00 - Roof Accessories: Roof hatches, vents, and manufactured curbs.
- E. Section 22 10 06 - Plumbing Specialties: Roof Drains

1.03 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
 - 1. American Society for Testing and Materials (ASTM) D 4434 - Standard Specification for Polyvinyl Chloride Sheet Roofing.
 - 2. American Society for Testing and Materials (ASTM) C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 3. American Society for Testing and Materials (ASTM) E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
 - 4. American Society for Testing and Materials (ASTM) C 1371 - Standard Test Method for Determination of Emittance of Material Near Ambient Temperature using Portable Emissometers.
 - 5. American Society for Testing and Materials (ASTM) C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.
 - 6. American Society for Testing and Materials (ASTM) C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2013 American Society of Civil Engineers (ASCE) 7 Minimum Design of Loads for Buildings and Other Structures.
 - 7. PS 1 - Construction and Industrial Plywood; 2009.
 - 8. PS 20 - American Softwood Lumber Standard; 2010.
 - 9. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2007. (ANSI/SPRI ES-1).
 - 10. Factory Mutual (FM Global) - Approved Product
 - 11. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and

recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

2. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.
3. Storage and handling requirements and recommendations.

B. Shop Drawings:

1. Provide the roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

C. Pre-Installation Notice: Copy to show that manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.

D. Specimen Warranty: Submit prior to starting work.

E. Samples: Submit samples of each product to be used.

1.05 QUALITY ASSURANCE

A. Manufacture Qualifications:

1. Membrane manufacturer shall have a minimum of twenty (20) years' experience in the production of thermoplastic scrim-reinforced membrane and related accessories.

B. Applicator Qualifications: Roofing installer shall have the following:

1. Current Firestone Master Contractor status.
2. At least five years' experience in installing specified system.

C. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.

1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
2. Notify Architect well in advance of meeting.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store in a clean, dry, well ventilated area protected from weather and other trades. All rolls of membrane shall be stored, lying down, elevated above the roof deck and completely protected from moisture with tarpaulins.

- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- D. Keep combustible materials away from ignition sources.

1.07 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.
- B. Weather: Proceed with the roof installation only when existing and forecasted weather conditions permit.

1.08 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Firestone 20-year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
 - 1. Limit of Liability: No dollar limitation.
 - a. Scope of Coverage: Repair leaks in the roofing system caused by:
 - b. Ordinary wear and tear of the elements.
 - c. Manufacturing defect in Firestone brand materials.
 - d. Defective workmanship used to install these materials.
 - e. Damage due to winds up to 55 mph.
 - 2. Not Covered:
 - a. Damage due to winds in excess of 55 mph.
 - b. Damage due to hurricanes or tornadoes.
 - c. Hail.
 - d. Intentional damage.
 - e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products Company, LLC, Nashville, TN. www.firestonebpco.com.
- B. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
 - 1. Specializing in manufacturing the roofing system to be provided.

2. Minimum ten years of experience manufacturing the roofing system to be provided.
 3. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
 4. ISO 9002 certified.
 5. Able to provide isocyanurate insulation that is produced in own facilities.
- C. Manufacturer of Insulation and Cover Board: Same manufacturer as roof membrane.
- D. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
1. Metal roof edging products by other manufacturers are not acceptable.
 2. Field- or shop-fabricated metal roof edgings are not acceptable.
- E. Substitution Procedures: See Instructions to Bidders.
1. Submit evidence that the proposed substitution complies with the specified requirements.

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:

1. Membrane: Reinforced Polyvinyl Chloride Thermoplastic (PVC).
2. Thickness: 60 mil.
3. Membrane Attachment: Adhered.
4. Slope: 1/4 inch per foot (1:48) by means slope in structural framing. Provide 1/4 inch per foot slope (1:48) by means of tapered insulation where structural framing slope is not present.
5. Comply with applicable local building code requirements.
6. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
7. Provide roofing membrane with Factory Mutual Corporation (FM) Approval

B. Vapor Barrier over deck/deck cover:

1. Membrane: High density polyethylene sheet with SBS modified bitumen adhesive.
2. Attachment: Self adhering.

C. Insulation:

1. Total System R-Value: 30 minimum.
2. Maximum Board Thickness: 3.5 inches use as many layers as necessary; stagger joints in adjacent layers.

System R Value	Total Iso Insulation Thickness, nominal
20 R	3.5 inches
25 R	4.5 inches

30 R	5.25 inches
35 R	6.25 inches

Use of Firestone ISOGARD HD cover board can provide an additional 2.5 R vs. gypsum-based cover boards. [Example: 2.0-inch Iso (11.4 R) + 2.0-inch Iso (11.4 R) + .5-inch HD Iso cover board (2.5 R) = 25.3 R]

3. Base Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Mechanical fastening
4. Top Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Low-rise polyurethane adhesive.

D. Tapered Polyisocyanurate Roof Insulation; ASTM C1289:

1. Qualities: Factory Tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
2. Thickness: Minimum 5".
3. Average R-Value: Minimum 30
4. Tapered Slope: 1/4"
5. Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1
6. Acceptable Products:
 - a. Firestones ISO 95+ GL
 - b. Approved Equivalent

E. Cover Board: Gypsum-Based Cover Board:

1. Thickness: 0.5 inch (12.7mm).
2. R-Value: negligible.
 - a. Attachment: Mechanical through fastening.

2.03 PVC MEMBRANE MATERIALS

- A. Membrane: Flexible, heat weldable sheet composed polyvinyl chloride thermoplastic (PVC) the roofing membrane shall meet or exceed the requirements of ASTM D4434 standard for polyvinyl chloride thermoplastic sheet roofing.

1. Reinforced PVC Membrane:
 - a. 60 mil PVC Reinforced
 - b. 80 mil PVC Reinforced
2. Color: White
3. Solar Reflectance Index (SRI): No less than 108 when calculated in accordance with ASTM E 1980.
4. Solar Reflectivity: No less than 0.86 when tested according to ASTM C 1549.
5. Thermal Emissivity Rating: Of at least 0.87 when tested in accordance with ASTM C 1371 for a minimum of at least 75 percent of the roof surface.
6. Acceptable Product: Firestone PVC.

7. Membrane Qualifications: Membrane shall be factory certified, first run material, seconds will not be permitted. Approvals:
 - a. UL Evaluation Report
 - b. Cool Roof Ratings Council (CRRC) Listed
 - c. Energy Star Partner
 - d. FM Approved Membrane
- B. Membrane Adhesive: Adhesive designed to attach fleece backed roofing membranes to a variety of acceptable substrates; by Firestone. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesive furnished by roof membrane manufacturer.
- C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.
- D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyvinyl chloride.
 1. Acceptable Product: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided.
 - a. Reinforced Membrane: same material, color and thickness as roof membrane for all curbs, walls and penetrations.
 - b. Non-reinforced Membrane: multi angled intersections, sealant pockets and other conditions that would be impractical for reinforced membrane application.
- E. Molded Flashing Accessories: Unreinforced PVC membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only products furnished by roof membrane manufacturer.
- F. General Purpose Sealant: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only products furnished by roof membrane manufacturer.
- G. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.
- H. Roof Walkway Pads: Non-reinforced PVC walkway pads 30 inches by 60 feet long with patterned traffic bearing surface; PVC Walkway Pads by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
 1. Thickness: As indicated elsewhere.
 2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.

3. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
 4. R-Value (LTTR): 1.0 inch (25 mm) Thickness: 5.7 R, minimum.
 5. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
 6. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
 7. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
 8. Acceptable Product: ISO 95+ polyiso board insulation by Firestone
or
 9. Acceptable Product: Resista polyiso board insulation by Firestone (mold resistant material per ASTM D3273)
- B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
1. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
 2. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
 3. Thickness: 0.5 inch (12.7mm).
 4. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.
 5. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 6. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
 7. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
 8. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 9. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.
- C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- D. Low Rise Polyurethane Foam Adhesive: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesive furnished by roof membrane manufacturer.
- 2.05 VAPOR BARRIER
- A. Vapor Barrier Membrane: Comprised of SBS modified bitumen adhesive, factory-laminated to a tri-laminate woven, high-density polyethylene top surface. Release liner protecting adhesive.

1. Intended for use as a direct to deck air/vapor barrier in roofing systems and may be used as a temporary roof membrane for up to ninety (90) days.
2. Thickness: 0.0325" (0.826 mm) minimum, when tested in accordance with ASTM D 5147.
3. Max Load at Break at 73 °F (23 °C): 64 lbf/in, MD (11 kN/m) 88 lbf/in, XMD (15 kN/m) when tested in accordance with ASTM D 5147.
4. Low Temperature Flexibility: -30 °F (-34 °C) when tested in accordance with ASTM D 5147.
5. Moisture Vapor Permeance, 0.02 Perms (0.92 Ng/Pa•s•m²) maximum, when tested in accordance with ASTM E 96.
6. Air Permeability: 0.00114 ft³/min•ft² (0.007 L/sec•m²) maximum, when tested in accordance with ASTM E 2178.

B. Acceptable Product: V-Force Vapor Barrier Membrane by Firestone.

2.06 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

1. Wind Performance:
 - a. Membrane Pull-Off Resistance: 100 lbs/ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
 - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
 - c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
2. Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia; Firestone EdgeGard.
3. Fascia Face Height: 5 inches (127 mm).
4. Edge Member Height Above Nailers: 1-1/4 inches (31 mm).
5. Length: 144 inches (3650 mm).
6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
8. Anchor Bar Cleat: 20 gauge, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
9. Curved Applications: Factory modified.
10. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
11. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
12. Scuppers: Welded watertight.

13. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.

1. Wind Performance:
 - a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
 - b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless-steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
3. Material and Finish: 24-gauge, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
4. Dimensions:
 - a. Wall Width: As indicated on the drawings.
 - b. Piece Length: Minimum 144 inches (3650 mm).
 - c. Curved Application: Factory fabricated in true radius.
5. Anchor/Support Cleats: 20-gauge, 0.036 inch (0.9 mm) thick pre-punched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72 inches (1820 mm) on center.
6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm) long legs on corner, intersection, and end pieces.
7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners.

2.07 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 2. Thickness: Same as thickness of roof insulation.

PART 3 - INSTALLATION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult roofing membrane manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the published application temperature range.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment, and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent seepage into building.

3.04 VAPOR BARRIER INSTALLATION

- A. All deck/deck cover substrates (except metal decks) must be primed prior to application. Use only primer supplied by membrane manufacturer.
- B. Expanded Polystyrene, Extruded Polystyrene, Common Polyisocyanurate, Fiberglass, Wood Fiber, Perlite and existing single-ply roofs are not acceptable substrates for SBS bitumen adhesive.
- C. Application can be made at ambient temperatures as low as 25 °F (-4 °C) as long as membrane has been stored in a heated area so that it will be between 50 °F (10 °C) and 100 °F (38 °C) at the time of application.
- D. Install with minimum 3" (76.2 mm) side laps and 6" (152.4 mm) end laps.
- E. Roll in with a 75 lb (34 kg) roller to fully mate each roll to substrate, including all lap areas.

3.05 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install insulation in a manner that will not compromise the vapor retarder integrity.
- C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- D. Lay roof insulation in courses parallel to roof edges.

- E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).
- F. Mechanical Fastening: Using specified fasteners and insulation plates, engage fasteners through insulation into deck to depth and in pattern as required by roof membrane manufacture. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided. Use only products furnished by roof membrane manufacturer.
- G. Adhesive Attachment: Using specified adhesive, engage deck to pattern and extent required by as required by roof membrane manufacture. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided. Use only products furnished by roof membrane manufacturer.

3.06 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; hot air weld and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane to the substrate using adhesive, mechanical fasteners and edge securement as specified and as required by membrane manufacturer. Use only products furnished by roof membrane manufacturer.
- E. The membrane shall be positioned to provide a minimum 3 inches (76 mm) wide finished lap joint for the length of the roll and a minimum 3 inches (76 mm) wide finished width for the end laps. Edge seam and end laps will be completed by the hot air welding method. Seams are to be completed promptly upon installation of sheet.
- F. All seams must be checked with a needle probe and any voids repaired with the heat gun the same day they are made. A T-Patch is required at all start/stop locations including all angle changes.
- G. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided. Use only products furnished by roof membrane manufacturer.
 - 1. Do not apply bonding material to seaming area of membrane.
- H. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically

fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.07 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
 1. Follow roofing manufacturer's instructions.
 2. Remove protective plastic surface film immediately before installation.
 3. Install water block sealant under the membrane anchorage leg.
 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.
- E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
 1. Use the longest practical flashing pieces.
 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 4. Provide termination directly to the vertical substrate as shown on roof drawings.

F. Roof Drains:

1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1-inch (25 mm) clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.08 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch (25 mm) and maximum of 3.0 inches (75 mm) from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
 2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.09 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION 075423.13

SECTION 075423.23 - PVC REINFORCED ADHERED ROOFING SYSTEM OVER CONCRETE

PART 1 - GENERAL

- 1.1 The project, Bertie County 911 Communications Center located in Windsor, NC, includes the provision of a complete Firestone Building Products: Firestone PVC Adhered Membrane Roofing System.

1.2 SUMMARY

- A. Furnish and install thermoplastic sheet roofing system, including:
1. Roofing manufacturer's requirements for the specified warranty.
 2. Preparation of roofing substrates.
 3. Wood nailers for roofing attachment.
 4. Vapor barrier.
 5. Insulation.
 6. Cover boards.
 7. Thermoplastic membrane roofing.
 8. Metal roof edging and copings.
 9. Flashings.
 10. Walkway pads.
 11. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer at <https://www.firestonebpc.com>.
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.3 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.
- C. Section 07 71 00 - Roof Specialties: Manufactured copings, fascia's, gravel stops, and other flashing-related items.

- D. Section 07 72 00 - Roof Accessories: Vents, and manufactured curbs.
- E. Section 22 10 06 - Plumbing Specialties: Roof drains

1.4 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
 - 1. American Society for Testing and Materials (ASTM) D 4434 - Standard Specification for Polyvinyl Chloride Sheet Roofing.
 - 2. American Society for Testing and Materials (ASTM) C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 3. American Society for Testing and Materials (ASTM) E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
 - 4. American Society for Testing and Materials (ASTM) C 1371 - Standard Test Method for Determination of Emittance of Material Near Ambient Temperature using Portable Emission meters.
 - 5. American Society for Testing and Materials (ASTM) C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.
 - 6. American Society for Testing and Materials (ASTM) C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2013American Society of Civil Engineers (ASCE) 7 Minimum Design of Loads for Buildings and Other Structures.
 - 7. PS 1 - Construction and Industrial Plywood; 2009.
 - 8. PS 20 - American Softwood Lumber Standard; 2010.
 - 9. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2007. (ANSI/SPRI ES-1).
 - 10. Factory Mutual (FM Global) - Approved Product
 - 11. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
 - 2. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.

3. Storage and handling requirements and recommendations.

B. Shop Drawings:

1. Provide the roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

C. Pre-Installation Notice: Copy to show that manufacturer's required Pre-Installation Notice (PIN) has been accepted and approved by the manufacturer.

D. Specimen Warranty: Submit prior to starting work.

E. Samples: Submit samples of each product to be used.

1.6 QUALITY ASSURANCE

A. Manufacture Qualifications:

1. Membrane manufacturer shall have a minimum of twenty (20) years' experience in the production of thermoplastic scrim-reinforced membrane and related accessories.

B. Applicator Qualifications: Roofing installer shall have the following:

1. Current Firestone Master Contractor status.
2. At least five years' experience in installing specified system.

C. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.

1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
2. Notify Architect well in advance of meeting.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store in a clean, dry, well ventilated area protected from weather and other trades. All rolls of membrane shall be stored, lying down, elevated above the roof deck and completely protected from moisture with tarpaulins.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

D. Keep combustible materials away from ignition sources.

1.8 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.
- B. Weather: Proceed with the roof installation only when existing and forecasted weather conditions permit.

1.9 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Firestone 20-year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.

Warranty	Membrane Thickness,
Duration	required minimums
20-year	60 mil or 80 mil Firestone PVC Reinforced

- 1. Limit of Liability: No dollar limitation.
 - a. Scope of Coverage: Repair leaks in the roofing system caused by:
 - b. Ordinary wear and tear of the elements.
 - c. Manufacturing defect in Firestone brand materials.
 - d. Defective workmanship used to install these materials.
 - e. Damage due to winds up to 55 mph.
- 2. Not Covered:
 - a. Damage due to winds in excess of 55 mph.
 - b. Damage due to hurricanes or tornadoes.
 - c. Hail.
 - d. Intentional damage.
 - e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products Company, LLC, Nashville, TN. www.firestonebpco.com.
- B. Roofing systems manufactured by others may be acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
 - 1. Specializing in manufacturing the roofing system to be provided.
 - 2. Minimum ten years of experience manufacturing the roofing system to be provided.

3. Able to provide a no dollar limit, single source roof system warranty that is backed by corporate assets in excess of one billion dollars.
 4. ISO 9002 certified.
 5. Able to provide isocyanurate insulation that is produced in own facilities.
- C. Manufacturer of Insulation and Cover Board: Same manufacturer as roof membrane.
- D. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
1. Metal roof edging products by other manufacturers are not acceptable.
 2. Field- or shop-fabricated metal roof edgings are not acceptable.
- E. Substitution Procedures: See Instructions to Bidders.
1. Submit evidence that the proposed substitution complies with the specified requirements.

2.2 ROOFING SYSTEM DESCRIPTION

- A. Roofing System:
1. Membrane: Reinforced Polyvinyl Chloride Thermoplastic (PVC).
 2. Thickness: 60 mil.
 3. Membrane Attachment: Adhered.
 4. Slope: 1/4 inch per foot (1:48) by means slope in structural framing. Provide 1/4 inch per foot slope (1:48) by means of tapered insulation where structural framing slope is not present.
 5. Comply with applicable local building code requirements.
 6. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
 7. Provide roofing membrane with Factory Mutual Corporation (FM) Approval
- B. Vapor Barrier over deck/deck cover:
1. Membrane: High density polyethylene sheet with SBS modified bitumen adhesive.
 2. Attachment: Self adhering.
- C. Insulation:
1. Total System R-Value: 30 minimum.
 2. Maximum Board Thickness: 3.5 inches use as many layers as necessary; stagger joints in adjacent layers.
- | | |
|---------|----------------------|
| System | Total Iso Insulation |
| R Value | Thickness, nominal |
| 20 R | 3.5 inches |
| 25 R | 4.5 inches |
| 30 R | 5.25 inches |

35 R 6.25 inches

Use of Firestone ISOGARD HD cover board can provide an additional 2.5 R vs. gypsum-based cover boards. [Example: 2.0-inch Iso (11.4 R) + 2.0-inch Iso (11.4 R) + .5-inch HD Iso cover board (2.5 R) = 25.3 R]

3. Base Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Low-rise polyurethane adhesive.
4. Top Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Low-rise polyurethane adhesive.

D. Cover Board: Gypsum-Based Cover Board:

1. Thickness: 0.5 inch (12.7mm).
2. R-Value: negligible.
 - a. Attachment: Mechanical through fastening.

2.3 PVC MEMBRANE MATERIALS

- A. Membrane: Flexible, heat weldable sheet composed polyvinyl chloride thermoplastic (PVC) the roofing membrane shall meet or exceed the requirements of ASTM D4434 standard for polyvinyl chloride thermoplastic sheet roofing.
 1. Reinforced PVC Membrane:
 - a. 60 mil PVC Reinforced
 - b. 80 mil PVC Reinforced
 2. Color: White
 3. Solar Reflectance Index (SRI): No less than 108 when calculated in accordance with ASTM E 1980.
 4. Solar Reflectivity: No less than 0.86 when tested according to ASTM C 1549.
 5. Thermal Emissivity Rating: Of at least 0.87 when tested in accordance with ASTM C 1371 for a minimum of at least 75 percent of the roof surface.
 6. Acceptable Product: Firestone PVC.
 7. Membrane Qualifications: Membrane shall be factory certified, first run material, seconds will not be permitted. Approvals:
 - a. UL Evaluation Report
 - b. Cool Roof Ratings Council (CRRC) Listed
 - c. Energy Star Partner
 - d. FM Approved Membrane
- B. Membrane Adhesive: Adhesive designed to attach fleece backed roofing membranes to a variety of acceptable substrates; by Firestone. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesive furnished by roof membrane manufacturer.

- C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.
- D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyvinyl chloride.
 - 1. Acceptable Product: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided.
 - a. Reinforced Membrane: same material, color and thickness as roof membrane for all curbs, walls and penetrations.
 - b. Non-reinforced Membrane: multi angled intersections, sealant pockets and other conditions that would be impractical for reinforced membrane application.
- E. Molded Flashing Accessories: Unreinforced PVC membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only products furnished by roof membrane manufacturer.
- F. General Purpose Sealant: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only products furnished by roof membrane manufacturer.
- G. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.
- H. Roof Walkway Pads: Non-reinforced PVC walkway pads 30 inches by 60 feet long with patterned traffic bearing surface; PVC Walkway Pads by Firestone.

2.4 ROOF INSULATION AND COVER BOARDS

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
 - 1. Thickness: As indicated elsewhere.
 - 2. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
 - 3. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
 - 4. R-Value (LTTR): 1.0 inch (25 mm) Thickness: 5.7 R, minimum.
 - 5. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
 - 6. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
 - 7. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
 - 8. Acceptable Product: ISO 95+ polyiso board insulation by Firestone

or

9. Acceptable Product: Resista polyiso board insulation by Firestone (mold resistant material per ASTM D3273)
- B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
1. Size: 48 inches (1220 mm) by 96 inches (2440 mm), nominal.
 2. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches (1220 mm) by 48 inches (1220 mm), nominal.
 3. Thickness: .5 inch (12.7mm).
 4. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.
 5. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 6. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
 7. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
 8. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 9. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.
- C. Low Rise Polyurethane Foam Adhesive: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesive furnished by roof membrane manufacturer.

2.5 VAPOR BARRIER

- A. Vapor Barrier Membrane: Comprised of SBS modified bitumen adhesive, factory-laminated to a tri-laminate woven, high-density polyethylene top surface. Release liner protecting adhesive.
1. Intended for use as a direct to deck air/vapor barrier in roofing systems and may be used as a temporary roof membrane for up to ninety (90) days.
 2. Thickness: 0.0325" (0.826 mm) minimum, when tested in accordance with ASTM D 5147.
 3. Max Load at Break at 73 °F (23 °C): 64 lbf/in, MD (11 kN/m) 88 lbf/in, XMD (15 kN/m) when tested in accordance with ASTM D 5147.
 4. Low Temperature Flexibility: -30 °F (-34 °C) when tested in accordance with ASTM D 5147.
 5. Moisture Vapor Permeance, 0.02 Perms (0.92 Ng/Pa•s•m²) maximum, when tested in accordance with ASTM E 96.
 6. Air Permeability: 0.00114 ft³/min•ft² (0.007 L/sec•m²) maximum, when tested in accordance with ASTM E 2178.

- B. Acceptable Product: V-Force Vapor Barrier Membrane by Firestone.

2.6 METAL ACCESSORIES

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

1. Wind Performance:

- a. Membrane Pull-Off Resistance: 100 lbs./ft (1460 N/m), minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
- b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
- c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.

2. Description: Two-piece; 45 degree sloped galvanized steel sheet edge member securing top and bottom edges of formed metal fascia; Firestone EdgeGard.
3. Fascia Face Height: 5 inches (127 mm).
4. Edge Member Height Above Nailer: 1-1/4 inches (31 mm).
5. Length: 144 inches (3650 mm).
6. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
7. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
8. Anchor Bar Cleat: 20 gauge, 0.036 inch (0.9 mm) G90 coated commercial type galvanized steel with pre-punched holes.
9. Curved Applications: Factory modified.
10. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
11. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch (355 mm) long legs on corner pieces.
12. Scuppers: Welded watertight.
13. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

- B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.

1. Wind Performance:

- a. At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-3, current edition.
 - b. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-90 rating.
2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless-steel springs factory attached to anchor cleats; 8 inch (200 mm) wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
3. Material and Finish: 24-gauge, 0.024 inch (0.06 mm) thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
4. Dimensions:
 - a. Wall Width: As indicated on the drawings.
 - b. Piece Length: Minimum 144 inches (3650 mm).
 - c. Curved Application: Factory fabricated in true radius.
5. Anchor/Support Cleats: 20-gauge, 0.036 inch (0.9 mm) thick pre-punched galvanized cleat with 12 inch (305 mm) wide stainless steel spring mechanically locked to cleat at 72 inches (1820 mm) on center.
6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch (355 mm) long legs on corner, intersection, and end pieces.
7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds (109 kg) for actual substrate used; no exposed fasteners.

2.7 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
 1. Width: 3-1/2 inches (90 mm), nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 2. Thickness: Same as thickness of roof insulation.

PART 3 - INSTALLATION

3.1 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult roofing membrane manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the published application temperature range.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.2 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment, and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.3 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent seepage into building.

3.4 VAPOR BARRIER INSTALLATION

- A. All deck/deck cover substrates (except metal decks) must be primed prior to application. Use only primer supplied by membrane manufacturer.
- B. Expanded Polystyrene, Extruded Polystyrene, Common Polyisocyanurate, Fiberglass, Wood Fiber, Perlite and existing single-ply roofs are not acceptable substrates for SBS bitumen adhesive.
- C. Application can be made at ambient temperatures as low as 25 °F (-4 °C) as long as membrane has been stored in a heated area so that it will be between 50 °F (10 °C) and 100 °F (38 °C) at the time of application.
- D. Install with minimum 3" (76.2 mm) side laps and 6" (152.4 mm) end laps.
- E. Roll in with a 75 lb (34 kg) roller to fully mate each roll to substrate, including all lap areas.

3.5 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install insulation in a manner that will not compromise the vapor retarder integrity.
- C. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- D. Lay roof insulation in courses parallel to roof edges.
- E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).
- F. Adhesive Attachment: Using specified adhesive, engage deck to pattern and extent required by as required by roof membrane manufacture. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided. Use only products furnished by roof membrane manufacturer.

3.6 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; hot air weld and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane to the substrate using adhesive, mechanical fasteners and edge securement as specified and as required by membrane manufacturer. Use only products furnished by roof membrane manufacturer.
- E. The membrane shall be positioned to provide a minimum 3 inches (76 mm) wide finished lap joint for the length of the roll and a minimum 3 inches (76 mm) wide finished width for the end laps. Edge seam and end laps will be completed by the hot air welding method. Seams are to be completed promptly upon installation of sheet.
- F. All seams must be checked with a needle probe and any voids repaired with the heat gun the same day they are made. A T-Patch is required at all start/stop locations including all angle changes.
- G. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures. Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided. Use only products furnished by roof membrane manufacturer.
 - 1. Do not apply bonding material to seaming area of membrane.
- H. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
 - 1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.
 - 2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.7 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.

1. Follow roofing manufacturer's instructions.
 2. Remove protective plastic surface film immediately before installation.
 3. Install water block sealant under the membrane anchorage leg.
 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.
- E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
1. Use the longest practical flashing pieces.
 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 4. Provide termination directly to the vertical substrate as shown on roof drawings.
- F. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
 2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
 3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
 4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
 5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

- G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
 - 1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
 - 2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1-inch (25 mm) clearance from penetration, sloped to shed water.
 - 3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
 - 4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.8 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch (25 mm) and maximum of 3.0 inches (75 mm) from each other to allow for drainage.
 - 1. If installation of walkway pads over field fabricated splices or within 6 inches (150 mm) of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches (150 mm) on either side.
 - 2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.9 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a salesperson).
- B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION 075423.23

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashing, site formed copings, gutters, downspouts, sheet metal roofing, exterior penetrations and other items indicated in contract documents.
- B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- G. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- I. CDA A4050 - Copper in Architecture - Handbook current edition.
- J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples illustrating metal finish color.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

- A. Stainless-Steel Sheet: ASTM A240 or ASTM A666, Type 304, 0.016 inch thick dead soft, fully annealed material.
- B. Clear Anodized Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.
 - 1. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.
 - 2. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils thick.
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - 2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 - 3. Color: As selected by architect.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.3 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- D. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.
- E. Downspout Boots: Cast iron.
- F. Seal metal joints.

2.4 EXTERIOR PENETRATION FLASHING PANELS

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.5 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.

- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- G. Plastic Cement: ASTM D4586/D4586M, Type I.
- H. Reglets: Recessed type, galvanized steel; face and ends covered with plastic tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Comply with drawing details.
- B. Insert flashings into reglets to form tight fit; secure in place with plastic wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Secure gutters and downspouts in place with concealed fasteners.
- H. Slope gutters 1/4 inch per 10 feet, minimum.
- I. Connect downspouts to downspout boots, and grout connection watertight.

3.4 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 076200

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Preformed, Prefinished Metal Soffit Panels.
2. Roof-Edge Specialties – Cant Metal Fascias, Formed Metal Fascias.
3. Roof-Edge Drainage Systems – Gutters, Downspouts, Scuppers, Scupper Boxes.
4. Walking Pads
5. Roof Penetration Sealing System

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

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects Roof Specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect Roof Specialties.

1.3 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings:

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between shop and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.

4. Detail termination points and assemblies, including fixed points.
 5. Include details of special conditions.
- C. Samples for Initial Selection: For each type of Roof Specialty indicated with factory-applied color finishes.
- D. Samples for Verification:
1. Include Samples of each type of Roof Specialty to verify finish and color selection, in manufacturer's standard sizes.
 2. Include roof-edge specialties, roof-edge drainage systems, and soffit panels made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and or fabricator.
- B. Product Certificates: For each type of Roof Specialty.
- C. Product Test Reports: For roof-edge flashings, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For Roofing Specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical roof edge specialties, approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store Roof Specialties in contact with other materials that might cause staining, denting, or other surface damage. Store Roof Specialties away from uncured concrete and masonry.

- B. Protect strippable protective covering on Roof Specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of Roof-Specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate Roof Specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No.8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof Specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install roof-edge flashings tested according to SPRIES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Architectural and Structural Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result

of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Sheet Metal Standard for Roofing Specialties: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.022 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
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. Architectural Products Company.
 - b. ATAS International, Inc.
 - c. Castle Metal Products.
 - d. Cheney Flashing Company.
 - e. Hickman Company, W. P.
 - f. Merchant & Evans, Inc.
 - g. Metal-Era, Inc.
 - h. Metal-Fab Manufacturing, LLC.
 - i. Petersen Aluminum Corporation.
 2. Formed Metal Sheet Fascia Covers: Metal sheet, thickness as required to meet performance requirements.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 3. Corners: Factory mitered and continuously welded.
 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 5. Special Fabrications: As indicated on Drawings.
- B. Formed Metal Fascia:
1. Manufactured, one-piece, formed-metal fascia in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg fascia terminating in a drip edge, continuous hold-down cleat, and concealed splice plates of same material, finish, and shape as fascia. Provide mitered and welded or soldered corner units.
 - a. Fabricate from the following: 22 gauge metal
 - b. Finish: Two-coat fluoropolymer.

- c. Color: As Selected by Architect from manufacturer's full range.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- 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. Architectural Products Company.
 - 2. ATAS International, Inc.
 - 3. Castle Metal Products.
 - 4. Cheney Flashing Company.
 - 5. Hickman Company, W. P.
 - 6. Metal-Era, Inc.
 - 7. Metal-Fab Manufacturing, LLC.
 - 8. National Sheet Metal Systems, Inc.
 - 9. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Formed Metal Sheet: 24 GA. thick.
 - 2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Corners: Factory mitered and continuously welded.
 - 4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
 - 5. Gutter Accessories: As selected by Architect.
- C. Downspouts: Shape as indicated on Drawings, complete with elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Formed Metal: 24 GA. thick.
- D. Scuppers: Manufactured scuppers with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.
 - 1. Manufacture scuppers from the following: 24 gauge formed metal
- E. Scupper Boxes: Manufactured scupper boxes with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes and exterior flange trim.
 - 1. Fabricate scupper boxes from the following: 24 gauge formed metal
- F. Metal Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.4 METAL SOFFIT PANELS

- 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. Firestone Metal Products.
 2. ATAS International, Inc.
 3. Peterson Aluminum Corporation.
- B. Basis of Design Product: UNA-Clad UC-500 vented flush seam, rolled formed, steel soffit panels as manufactured by Firestone Metal Products or approved equivalent.
- C. Panel Materials and Fabrication:
 1. Factory Formed, Prefinished, Vented Steel Panels: ASTM A653, 24-gauge, G90 (lock-forming quality), extra smooth, tension-leveled, galvanized steel, minimum spangle.
 2. Form panels in longest practical lengths, true to shape, accurate in size, square, and free from distribution or manufacturing defects.
 - a. Panel Depth: 1 inch.
 - b. Panel Width: 12 inches.
 3. Fabricate panels with an interlocking leg (male/female interlocking joint design).
 4. Color to be selected by Architect from manufacturer's full range of colors.
 5. Texture: Panel shall be smooth.
 6. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
 7. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
 8. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting. Trim to be fabricated in accordance with standard SMACNA procedure and details.
 9. Closures: shall be pre-molded polyethylene to match the profile of the exposed fastener panel and shall be in lengths as supplied by the panel manufacturer.
 10. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous

framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity.

- a. Fasteners shall have combination steel and EPDM washers
- b. Screws for panel to girt/purlins shall be sufficient to penetrate the supporting member by 1 ". All fasteners shall be applied in accordance with the fastening schedule as provided by panel manufacturer.
- c. Screws for flashing and sidelaps shall be #14 HHA x 3/4" sheet metal stitch screws. All accessories, flashings and sidelaps shall be fastened 12" OC.

2.5 MATERIALS

- A. Metallic-Coated Steel Sheet Provide zinc-coated (galvanized) steel sheet according to ASTMA653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTMA755/A755M.
 1. Surface: Smooth, flat.
 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 3. Color: As selected by Architect from manufacturer's full range.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or pol yester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.7 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ROOF WALK PADS

- A. Roof Walk Pads: Factory fabricated to sizes required.
 - 1. Basis of Design: Tuff Trac PVC Roof Walkway by RM Biltrite <https://www.rmbiltrite.com/>
 - 2. Walkway pad color and pattern TBD from manufacturer standard range.
 - 3. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils thick.
 - 4. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.9 ROOF PENETRATION SEALING SYSTEMS

- A. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate penetrations where applicable.
 - 1. Sealant for Joints in Linear Components: As recommended by component manufacturer.
 - 2. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.
 - 3. Insulation Board Adhesive: Two-component, low-rise polyurethane foam adhesive used for adhering insulation to low slope roof deck materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Install Roof Specialties according to manufacturer's written instructions. Anchor Roof Specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete Roof-Specialty systems.
 - 1. Install Roof Specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install Roof Specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of Roof Specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- 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. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of Roof Specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed Roof Specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with elastomeric or butyl sealant as required by Roofing-Specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 - 1. Provide elbows at base of downspout to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- D. Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 - 2. Loosely lock front edge of scupper with scupper box.
 - 3. Seal or solder exterior wall scupper flanges into back of scupper box.
- E. Scupper Box: Anchor securely to wall at elevation as shown on drawing.

3.5 METAL PANEL SOFFIT INSTALLATION

- A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing.
- B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation. Conform to standards set forth in SMACNA architectural sheet metal manuals and approved shop drawings for this project.
- C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.
- D. Install panel system so it is watertight, without waves, warps, buckles, or distortions and allow for thermal movement considerations.
- E. Abrasive devices shall not be used to cut on or near roof or wall panel system.

- F. Apply sealant tape or caulking as necessary at flashing and panel joints to prevent water penetration.
- G. Remove any strippable film immediately upon exposure to direct sunlight.

3.6 ROOF WALK PADS ROOF PENETRATION SEALING SYSTEMS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Comply with NRCA (RM) drawing details as noted:
- E. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- F. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- G. Coordinate installation of flashing flanges into reglets.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- B. Replace Roof Specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

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SECTION 077129 – MANUFACTURED ROOF EXPANSION JOINTS

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. Metal-flanged, bellows-type roof expansion assemblies.
 - 2. Aluminum roof expansion assemblies.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wooden curbs for mounting roof expansion assemblies.
 - 2. Division 7 Section "PVC Reinforced Adhered Roofing System".
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
 - 4. Division 7 Section "Roof Specialties" for other manufactured roof items.
 - 5. Division 7 Section "Fire-Resistive Joint Systems" for fire-resistive joint systems in construction other than roofs.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide roof expansion assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, intersections, transitions, fittings, and attachments to other work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.
- C. Samples: For each type of exposed factory-applied finish required, prepared on Samples of size to adequately show color.
 - 1. Include similar Samples of material for assemblies and accessories involving color selection.

- D. Research/Evaluation Reports: For roof expansion assemblies.
- E. Warranties: Special warranties specified in this Section.
- F. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roof membrane.
- B. Source Limitations: Obtain metal-flanged, bellows-type roof expansion assemblies approved by roofing membrane manufacturer and that are part of roofing membrane warranty.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of roof expansion assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.
 - 1. Fire-Resistance Ratings: UL 2079.
 - 2. Fire-Resistance Ratings: ASTM E 119.

1.6 SCHEDULING

- A. Coordinate delivery and installation of roof expansion assemblies to prevent damage and provide timely integration of units with roofing membranes and flashing.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace roof expansion assemblies that leak, deteriorate in excess of rates specified in manufacturer's published product literature, or otherwise fail to perform within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 METALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275), stretcher-leveled standard of flatness and either commercial or forming steel, minimum 0.019 inch thick.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness, minimum 0.015 inch thick.
- C. Copper Sheet: ASTM B 370, Temper H00 (cold rolled) unless Temper 060 is required for forming, minimum 16 oz./sq. ft.
- D. Sheet Aluminum: ASTM B 209 (ASTM B 209M); Alloy 3003-H14, 5052-H32, or 6061-T6; minimum 0.032 inch thick.
- E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or 6063-T52, minimum 0.040 inch thick.
- F. Aluminum Finishes:
 1. Mill Finish: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing is required to removed scratches, welding, or grinding produced in fabrication process).
 2. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

3. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: As selected by Architect from manufacturer's full range.
4. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

- A. Roof Cement: ASTM D 4586, Type II.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight.
- C. Mineral-Fiber Blanket: ASTM C 665.
- D. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.
- E. Silicone Extrusions: Classified according to ASTM D 2000, UV stabilized, and do not propagate flame.
- F. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

2.4 FIRE BARRIERS

- A. Fire Barriers: Devices complying with requirements specified in Part 1 "Quality Assurance" Article for fire-test-response characteristics and designed for dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Provide roof expansion assemblies with manufacturer's continuous, standard, flexible fire-barrier seals in back of joint system at locations indicated to provide fire-resistance rating not less than rating of adjacent construction.

2.5 BELLOWS-TYPE ROOF EXPANSION ASSEMBLIES

- A. Metal-Flanged, Bellows-Type Roof Expansion Assemblies: Provide manufacturer's standard assemblies of sizes and types indicated, with prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof and roof-to-wall applications.
- B. Provide assemblies consisting of exposed polymeric sheet over foam bellows, securely anchored at both edges to 4-inch wide sheet metal nailing flanges, either flat or angle formed to fit cant or curbs as required. Insulate bellows with closed-cell, flexible rubber or plastic foam not less than 5/16 inch thick; adhere bellows to underside of polymeric sheet.
 - 1. Products:
 - a. Architectural Art Mfg., Inc.; T Series Roof Expansion Cover.
 - b. Balco Metalines, a division of Balco, Inc.; Roof Bellows.
 - c. BMCA Insulation Products, Inc., GAF Materials Corporation; Metalastic.
 - d. C/S Group.
 - e. Johns Manville.
 - f. JointMaster, a division of InPro Corporation.
 - g. MM Systems Corporation; Series.
 - h. Watson Bowman Acme Corp.
 - 2. Polymeric Sheet: Coordinate with roofing membrane.
 - 3. Metal Flanges: Zinc-coated (galvanized) steel, minimum 0.019 inch thick.
 - a. Mortar Flanges: Where flanges will be embedded in concrete or mortar, provide manufacturer's standard perforated-metal mortar flanges.
 - 4. Moisture Barrier: Manufacturer's standard, flexible, continuous, polymeric moisture barrier looped under roof expansion assemblies at locations indicated. Fill space with blanket-type, mineral-fiber insulation.
 - 5. Fire Barrier: Provide manufacturer's standard fire barrier.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials unless more stringent requirements are indicated.
- B. Coordinate installation of roof expansion assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- C. Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of roof expansion assembly, including transitions and end joints.

- D. Extend roof expansion assemblies over curbs, parapets, cornices, gutters, valleys, fasciae, and other elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.
 - 1. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems, specified in Division 5 Section "Architectural Joint Systems," to provide continuous, uninterrupted, watertight construction.
- E. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.
- F. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.
- G. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.
- H. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer but not less than 6 inches on centers.
- I. Anchor roof expansion assemblies complying with manufacturer's written instructions.
- J. On single-ply roofing, install roof expansion assemblies complying with manufacturer's written instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and roof expansion assembly. Cover flanges with stripping or flashing and install according to requirements in Division 7 Section "Thermoplastic Polyolefin (TPO) Roofing."

3.2 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that roof expansion assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 077129

SECTION 078100 - APPLIED FIREPROOFING

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 sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans, schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.
 - 1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups of fireproofing.
 - 1. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 - 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use

natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- C. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design.
 - 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. Carboline Company; AD Southwest Fireproofing Type 5GP.
 - b. Grace Construction Products; Monokote MK-6 Series.
 - c. Isolatek International; Cafco 300.
 - d. Pyrok, Inc.; Pyrok-HD.
 - e. Schundler Company (The); Classic 5 LD.
 - f. Southwest Fireproofing Products Co.; Type 5EF.
 - 2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 - 3. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 4. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
 - 5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
 - 6. Combustion Characteristics: ASTM E 136.
 - 7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 10 or less.
- b. Smoke-Developed Index: 10 or less.
- 8. Compressive Strength: Minimum 10 lbf/sq. in. according to ASTM E 761.
- 9. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- 10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- 11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
- 12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
- 13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
- 14. Finish: As selected by Architect from manufacturer's standard finishes.
 - a. Color of Topcoat: As selected by Architect from manufacturer's full range.

2.3 EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

- A. Available Products: Subject to compliance with requirement, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Fire-Resistive, Non-Water Based, Intumescent Mastic Coating Material:
 - a. Albi Manufacturing, Division of StanChem Inc., Albi Clad 800.
 - b. Carboline Company, Fireproofing Products Div., Nulifire System E.
 - c. International Paint Inc., Chartek 7.
 - d. Isolatek International Corp., Cafco SprayFilm-SF II basecoat and topcoat recommended by manufacturer of basecoat.
 - e. Nu-Chem Inc., Thermo-Sorb and topcoat provided by manufacturer of basecoat.
- B. Fire-Resistive, Intumescent Mastic Coating: Factory-mixed formulation
 - 1. Fire-Resistive, Non-Water Based, Intumescent Mastic Coating Material:
 - a. Non-water-based Formulation: Approved by manufacturer and UL or another testing and inspecting agency acceptable to authorities having jurisdiction and tested per ASTM E1529 and tested per UL 1709.
 - b. Multicomponent system consisting of intumescent base coat and topcoat.
- C. Color and Gloss: As indicated by manufacturer's designation.
- D. Locations: As noted in drawings.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 - 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- G. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other

- foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
- 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
- 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- D. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

E. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

F. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

G. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

H. Extend fireproofing in full thickness over entire area of each substrate to be protected.

I. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 APPLICATION, EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

A. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

B. Apply intumescent mastic fire-resistive coatings as follows:

1. Install reinforcing fabric as required to obtain designated fire-resistance rating.
2. Finish: Spray-textured finish with no further treatment.
3. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 1. Test and inspect as required by the IBC, 1704.10.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.6 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. **Fire-Test-Response Characteristics:** Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- C. **Preinstallation Conference:** Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

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. A/D Fire Protection Systems Inc.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. RectorSeal Corporation.
 7. Specified Technologies Inc.
 8. 3M Fire Protection Products.
 9. Tremco, Inc.; Tremco Fire Protection Systems Group.
 10. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or 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. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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 - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. **Fire-Test-Response Characteristics:** Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. **Preinstallation Conference:** Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. **Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.**

1.7 COORDINATION

- A. **Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.**
- B. **Coordinate sizing of joints to accommodate fire-resistive joint systems.**
- C. **Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.**

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint 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 fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies, and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 3. 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. EMSEAL
 - b. Fibrex Insulations, Inc.
 - c. Passive Fire Protection Partners.
 - d. 3M Fire Protection Products.
 - e. Thermafiber Corp.
 - f. Roxul Inc.
 - g. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - 2. 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. EMSEAL
 - b. A/D Fire Protection Systems Inc.
 - c. Grace Construction Products.
 - d. Hilti, Inc.
 - e. Johns Manville.
 - f. Nelson Firestop Products.
 - g. NUCO Inc.
 - h. Passive Fire Protection Partners.
 - i. RectorSeal Corporation.
 - j. Specified Technologies Inc.
 - k. 3M Fire Protection Products.
 - l. Thermafiber, Inc.
 - m. Tremco, Inc.; Tremco Fire Protection Systems Group.

- n. USG Corporation.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
- 1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
 - 2. 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. EMSEAL
 - b. A/D Fire Protection Systems Inc.
 - c. Grace Construction Products.
 - d. Hilti, Inc.
 - e. Johns Manville.
 - f. Nelson Firestop Products.
 - g. NUCO Inc.
 - h. Passive Fire Protection Partners.
 - i. RectorSeal Corporation.
 - j. Specified Technologies Inc.
 - k. 3M Fire Protection Products.
 - l. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - m. USG Corporation.
- E. Exposed Fire-Resistive Joint Systems: Provide products with 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 fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support 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 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.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint 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 - Fire-Resistive Joint System - 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.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.

END OF SECTION 078446

SECTION 079100 - PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Compression gaskets.
- B. Preformed strip seals.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.03 REFERENCE STANDARDS

- A. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber 2014.
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).
- C. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements 1991 (Reapproved 2016).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.
- C. Color Cards: For color selection.
- D. Samples for Color Selection: 4-inch-long pieces of each color available; at least 2 samples of each color.
- E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least three years of documented experience.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a two-year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 COMPRESSION GASKETS

- A. Compression Gasket: Extruded hollow polychloroprene (neoprene) gasket complying with ASTM D2628; not requiring blockout recess in substrate; not requiring vacuum to collapse seal for installation.
 - 1. Color: Black.
 - 2. Durometer Hardness, Type A: Within 55 to 65, when tested in accordance with ASTM D2240.
 - 3. Calculate size in accordance with manufacturer's recommendations.
 - 4. Measure size of existing joints before selecting seal width.
 - 5. Applications:

- a. Exterior wall expansion joints.
- B. Compression Gasket: Extruded hollow gasket made of closed cell expanded rubber complying with ASTM D1056, with dense surface skin and serrated sidewalls.
 - 1. Color: Black.
 - 2. Durometer Hardness, Type OO: Within 35 to 65, when tested in accordance with ASTM D2240.
 - 3. Calculate size in accordance with manufacturer's recommendations.
 - 4. Measure size of existing joints before selecting seal width.
 - 5. Adhesive: Epoxy sealant/adhesive recommended by gasket manufacturer.
 - 6. Applications:
 - a. Exterior wall expansion joints.

2.02 PREFORMED STRIP SEALS

- A. Preformed Strip Seal: Factory formed profile for adhered application to face of joint substrate.
 - 1. Measure size of existing joints before selecting seal width.
 - 2. Provide compatible materials for application as recommended by manufacturer.
 - 3. Applications:
 - a. Exterior wall expansion joints.

2.03 ACCESSORIES

- A. Adhesive: As recommended by seal manufacturer.
- B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.
- C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.
- D. Primer: Type recommended by seal manufacturer to suit application; non-staining.
- E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive this work.
- B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

- A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Compression Gaskets:
 - 1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
 - 2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
 - 3. Remove loose materials and foreign matter that could impair adhesion of sealant.

4. Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.
- C. Preformed Strip Seals:
1. Install when ambient temperature is within recommended application temperature range of adhesive and consult with manufacturer before installing outside this temperature range.
 2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
 3. Remove loose materials and foreign matter that could impair adhesion.
 4. When installing over existing non-functioning sealant, remove portions of existing installation that protrude beyond surface; install backing tape on surface of existing sealant installation to prevent adhesion of strip seal.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

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SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Polysulfide joint sealants.
 - 4. Latex joint sealants.
 - 5. Solvent-release-curing joint sealants.
 - 6. Preformed joint sealants.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction compatibility and adhesion test reports.
- C. Preconstruction field-adhesion test reports.

- D. Field-adhesion test reports.
- E. Sample warranties.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace 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 joint-sealant manufacturer agrees to furnish 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 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 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. Momentive Performance Materials; GE Construction Sealants; SCS2700 SilPruf LM .
 - b. Sika Corporation U.S.; Sikasil WS-290.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 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 Corning Corporation; 791.
 - b. Momentive Performance materials; GE Construction Sealants; SCS2000 SilPruf.
 - c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 265 LTS.
 - d. Pecora Corporation; PCS.
 - e. Sika Corporation U.S.; Sikasil WS-295.
- C. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 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 Corning Corporation; 758.
 - b. Momentive Performance Materials; GE Construction Sealants; SCS2350.
 - c. Polymeric Systems, Inc.; PSI-631.
 - d. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
- D. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 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 Corning Corporation; NS.
 - b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 728 NS.

- E. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
 - 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 Corning Corporation; 799.
 - b. Soudal USA; RTV 50.
- F. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
 - 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. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 199 PG.
 - b. Sika Corporation U.S.; Sikasil-N Plus US.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 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. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 290 FPS-NB.
 - b. Pecora Corporation; 890FTS/TXTR, or 890 NST.
 - c. Tremco Incorporated; Spectrem 1.
- C. Exterior Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 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. Pecora Corporation; 864NST.
 - b. Dow Corning Corporation; 795.
 - c. Momentive Performance Materials; GE Construction Sealants; SilPruf NB.
 - d. Tremco Incorporated; Spectrem 2.

2. Applications: Use for exterior non-traffic bearing joints:
 - a. Control and soft joints in masonry.
 - b. Joints between concrete or stone and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior non-traffic bearing joints for which no other sealant is indicated.
- D. Exterior Silicone (EIFS Systems), Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
 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. Pecora Corporation; 890HST.
 - b. Dow Corning Corporation; 790.
 - c. Momentive performance Materials; GE Construction Sealants; SilPruf NB.
 - d. Tremco Incorporated; Spectrem 1.
- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
 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. Tremco Incorporated; Spectrem 4-TS.

2.4 URETHANE JOINT SEALANTS

- A. Interior Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 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. Pecora Corporation; Dynatrol I-XL.
 - b. Sherwin-Williams Company (The); Stampede-1.BASF Construction Chemicals, LLC, Building Systems; Sonalastic TX1.
 - c. Tremco Incorporated; Dymonic.
 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between interior surfaces and exterior wall components.
 - c. Other interior dynamic joints.

- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 - 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. BASF Construction Chemicals, LLC, Building Systems; Sonolastic SL 1.
 - b. Pecora Corporation; NR-201.
 - c. Polymeric Systems, Inc.; Flexiprene 952.
 - d. Schnee-Morehead, Inc.; an ITW company; Permthane SM7101.
 - e. Sherwin-Williams Company (The); Stampede 1SL.
- C. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
 - 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. Pecora Corporation; Dynatrol II.
- D. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
 - 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. Sherwin-Williams Company (The); Stampede-2NS.
- E. Exterior Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
 - 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. Tremco Incorporated; Dymeric 240.
 - b. BASF Building Systems; Sonneborn; NP 2.
 - 2. Applications: Use for exterior non-traffic bearing joints, except EIFS joints.
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior non-traffic bearing joints for which no other sealant is indicated.

- F. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.
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. Bostik, Inc.; Chem-Calk 505.
 - b. LymTal International, Inc.; Iso-Flex 881.
 - c. Sika Corporation U.S.; Sikaflex - 2c NS EZ Mix.
- G. Traffic Joints Urethane, M, P, 25, T, NT: Multicomponent, pourable, self leveling, plus 25 percent and minus 25 percent movement capability, traffic use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
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. Pecora Corporation; Urexpam NR 200
 - b. Sherwin-Williams Company (The); Stampede-2SL.
 - c. Tremco Incorporated; THC 900/901.
 - d. BASF Building Systems; Sonneborn; Sonolastic SL2.
 2. Applications: Use for interior and exterior horizontal traffic bearing joints:
 - a. Joints in concrete floors and paving.
 - b. Soft joints in unit pavers.
 - c. Other traffic bearing joints for which no other sealant is indicated.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
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. Pecora; 898; Sanitary Mildew Resistant Silicone Sealant.
 - b. Dow Corning Corporation; 786-M White.
 - c. Momentive performance materials; GE Construction Sealants; SCS1700 Sanitary.
 - d. Tremco Incorporated; Tremsil 200.
 2. Applications: Use for kitchens, bathrooms, toilet rooms, lockers, and other wet areas:

- a. Joints between plumbing fixtures and floor and wall surfaces.
- b. Joints between kitchen and bath countertops and wall surfaces.
- c. Joints between lockers and toilet accessories and adjacent surfaces.
- d. Joints between sanitary wall panels and adjacent or penetrating materials.

2.6 LATEX JOINT SEALANTS

- A. Interior Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF. single component, nonstaining, nonbleeding, nonsagging.
 - 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. Pecora Corporation; AC-20.
 - b. Sherwin-Williams Company (The); 950A.
 - c. BASF Construction Chemicals, LLC, Building Systems; Sonolac.
 - d. Tremco Incorporated; Tremflex 834.
 - 2. Applications: Use for interior joints, except where sanitary sealant is required.
 - a. Interior wall and ceiling control joints.
 - b. Interior joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.

2.7 BUTYL JOINT SEALANTS

- A. Exterior Metal Lap Joint Sealant: ASTM C1311, butyl or polyisobutylene, nondrying, non-skinning, non-curing.
 - 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. Pecora; BC-98; Butyl Rubber Sealant.
 - b. Sherwin-Williams; White Lightning; Butyl Rubber Caulk.
 - c. Tremco, Inc.; Tremco Butyl Sealant.
 - 2. Applications: Concealed sealant bead in sheet metal and flashing work:
 - a. Concealed sealant bead in sheet metal work.
 - b. Concealed sealant bead in siding overlaps.
 - c. Concealed sealant bead in vapor barrier.
 - d. Concealed sealant bead in through wall flashing.
 - e. Other concealed sealant joints where specified in other Sections.

2.8 POLYSULFIDE JOINT SEALANTS

- A. Polysulfide Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Class 25, Uses NT, M, G, and A; suitable for continuous water immersion when tested in accordance with ASTM C1247; multi-component.

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. Pecora; Synthacalk GC2+.
2. Applications: Use for joints in subject to constant water exposure.
 - a. Joints in fountain pool.
 - b. Aquarium joints.

2.9 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), or Type 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.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.10 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.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.
 2. Clean nonporous joint substrate 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 by joint-sealant manufacturer or as indicated by 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 or primer 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.

3.3 INSTALLATION OF JOINT SEALANTS

- 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. Install sealant backings of kind 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.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. 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.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. 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.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 079219 – ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

- A. Acoustic Joint Sealant: "Acoustic Joint Sealant or Spray: Material or combination of materials used to achieve specified acoustical rating of non fire-rated assembly by providing an effective barrier against sound transmission through construction joint and through penetration openings."

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested acoustic systems shall be used in specific locations as follows:

- A. Top and bottom of gypsum board partitions.
- B. Top of masonry walls.
- C. Through-penetrations in gypsum and masonry walls.

1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Division 03 30 00 – Concrete
 - 2. Division 04 00 00 – Masonry
 - 3. Section 07 80 00 – Firestopping
 - 4. Section 07 86 00 – Smoke Seals
 - 5. Section 07 92 00 – Joint Sealants
 - 6. Section 09 29 00 – Gypsum Sheathing
 - 7. Division 21 00 00 – Fire Suppression
 - 9. Division 22 00 00 – Plumbing
 - 10. Division 23 00 00 – Heating, Ventilating, and Air-Conditioning
 - 11. Division 26 00 00 – Electrical
 - 12. Section 27 10 00 – Structured Cabling

1.05 REFERENCES

A. Test Requirements:

1. ASTM C734, Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
2. ASTM C834, Standard Specification for Latex Sealants
3. ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications
4. ASTM D217, Standard Test Methods for Cone Penetration of Lubricating Grease
5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
7. ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
8. ISO 11600, Building construction -- Jointing products -- Classification and requirements for sealants

B. All major building codes: IBC, SBCCI, BOCA

1.06 QUALITY ASSURANCE

- A. Installing contractor shall arrange for the acoustic joint sealant manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of acoustic sealant and spray systems to train appropriate contractor personnel in proper selection and installation procedures.
- B. Acoustical sealants shall be installed per manufacturer's written recommendations published in their literature and drawing details.

1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including documentation of STC testing and manufacturer's installation instructions in accordance with Section 01 30 00.
- B. Submit material safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the acoustic sealant and acoustic spray manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its acoustical sealant products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of acoustical sealants after completion of gypsum wall board but prior to covering or concealing of joints.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of acoustical sealant materials when temperatures are outside the manufacturers recommended limitations.
- E. During installation, provide masking and drop cloths to prevent acoustical sealant materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 ACOUSTICAL SEALANTS

- A. Acoustic Sealant for Exposed and Concealed Joints and annular spaces around through-penetrations: Provide manufacturer's standard non-sag, paintable, non-staining, butyl-free latex sealant complying with ASTM C834, ASTM C919 and the following:
 - a. Sealant effectively reduces airborne sound transmission through head-of-wall and bottom-of-wall joints and openings to accommodate through-penetrations in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
 - b. Acoustical Sealant to maintain STC ratings at sound rated partitions as indicated on the drawings.
 - c. Sealant has flame-spread and smoke-developed ratings of less than 25 as tested in accordance with ASTM E84.
 - d. Sealant is mold and mildew resistant per ASTM G21 with a rating of zero (0), "no growth".

- e. Sealant has movement capability of minimum 12.5% in accordance with ISO 11600.
Latex sealant according to ASTM C 834 class OP -18°C with shrinkage according to ASTM C 1241 < 25 % C.
- f. Proposed acoustic sealant materials and methods shall conform to applicable governing codes having local jurisdiction.
- g. Furnish fire rated sealant for use in fire rated assemblies.

2.02 ACOUSTICAL SPRAYS

- A. Acoustic Spray for exposed and concealed joints: Provide manufacturer's standard sprayable latex material complying with ASTM C919 and the following:
 - a. Spray effectively reduces airborne sound transmission through head-of-wall joints in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
 - b. Acoustical Spray to maintain STC ratings at sound rated partitions as indicated on the drawings.
 - c. Spray has flame-spread and smoke-developed ratings of less than 25 as tested in accordance with ASTM E84.
 - d. Spray is mold and mildew resistant per ASTM G21 with a rating of zero (0), "no growth".
 - e. Spray has movement capability of minimum 12.5%.
 - f. Proposed acoustic spray materials and methods shall conform to applicable governing codes having local jurisdiction.

2.03 ACCEPTABLE MANUFACTURERS

- 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. Non-Fire Rated Sealants:
 - 1) Pecora Corp.; AIS-919.
 - 2) Tremco, Inc.; Tremflex 834.
 - 3) Hilti, Inc.
 - b. Fire Rated Sealants:
 - 1) Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - 2) Tremco, Inc.; TremStop Acrylic.
 - 3) Hilti, Inc.
- 2. Applications: For use:
 - a. Through perimeter joints and openings in building construction.

2.04 MATERIALS

- 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. Hilti CP 506 Smoke and Acoustic Sealant
 - 2. Hilti CP 572 Smoke and Acoustic Spray
 - 3. Hilti CP605 bottom of wall sealant

2.05 ACCESSORIES

- A. Pre-formed mineral wool, subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following (pre-formed mineral wool products are to be sourced from the same manufacturer as the sealant/spray):
 - 1. CP 767 Speed Strips
 - 2. CP 777 Speed Plugs
- B. Mineral wool

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Verify acoustic joints are properly sized and in suitable condition for application of materials.
 - 2. Surfaces to which acoustic sealant and spray materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by acoustic sealant and spray materials.
 - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of acoustic sealant and spray.
 - 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Comply with acoustic sealant and spray manufacturer's written installation instructions for products and applications indicated.
- B. Standards: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

- C. Install acoustic sealant backings of type indicated to support sealant and spray during application in accordance with manufacturer's written installation instructions.
- D. Install acoustic sealant and spray free of air pockets, embedded foreign matter, sags and ridges.
- E. 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 acoustic sealant from surfaces adjacent to joint.
 - 2. Remove excess acoustic spray from surfaces adjacent to joint as indicated on the drawings.
 - 3. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 4. Provide concave joint configuration per Figure 8A in ASTM C1193, unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

- A. Examine acoustic joints and penetrations to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.

3.04 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturer of acoustical joint sealants.
- B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises.

3.05 PROTECTION

- A. Protect acoustic joints during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Contract Completion.

END OF SECTION 079219

SECTION 079500 - EXPANSION CONTROL

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 expansion control systems.
 - 2. Exterior wall expansion control systems.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- B. Samples for Initial Selection: For each type of expansion control system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- C. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.
- D. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion control system.
 - 2. Expansion control system location cross-referenced to Drawings.
 - 3. Nominal joint width.
 - 4. Movement capability.
 - 5. Classification as thermal or seismic.
 - 6. Materials, colors, and finishes.
 - 7. Product options.
 - 8. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.
- B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor is 1.0.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 - 1. Construction Specialties, Inc.

2. Balco, Inc.
 3. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
 4. JointMaster/InPro Corporation.
 5. MM Systems Corporation.
 6. Nystrom, Inc.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Floor-to-Floor:
1. Basis-of-Design Product: Construction Specialties, Inc.; Model as indicated on Drawings.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: As indicated on Drawings.
 - e. Load Capacity: As indicated on Drawings.
 - f. Fire-Resistance As indicated on Drawings.
 3. Type: Glide plate.
 - a. Cover-Plate Design: Serrated.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Manufacturer's standard.
- D. Floor-to-Wall:
1. Basis-of-Design Product: Construction Specialties, Inc.; Model as indicated on Drawings.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: As indicated on Drawings.
 - e. Load Capacity: As indicated on Drawings.
 - f. Fire-Resistance As indicated on Drawings.
 3. Type: Glide plate.
 - a. Cover-Plate Design: Serrated.

1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.

b. Metal: Aluminum.

1) Finish: Manufacturer's standard.

E. Wall-to-Wall:

1. Basis-of-Design Product: Construction Specialties, Inc.; Model as indicated on Drawings.

2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
- b. Minimum Joint Width: As indicated on Drawings.
- c. Maximum Joint Width: As indicated on Drawings.
- d. Type of Movement: As indicated on Drawings.
- e. Fire-Resistance As indicated on Drawings.

3. Type: Snap-on cover.

a. Metal: Aluminum.

1) Finish: Manufacturer's standard.

F. Wall Corner:

1. Basis-of-Design Product: EMSEAL; KF250.

2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
- b. Minimum Joint Width: As indicated on Drawings.
- c. Maximum Joint Width: As indicated on Drawings.
- d. Type of Movement: As indicated on Drawings.
- e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that indicated.

3. Type: Snap-on cover.

a. Metal: Aluminum.

1) Finish: Manufacturer's standard.

G. Wall-to-Ceiling:

1. Basis-of-Design Product: Basis-of-Design Product: Construction Specialties, Inc.; Model as indicated on Drawings.

2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
- b. Minimum Joint Width: As indicated on Drawings.

- c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: As indicated on Drawings.
 - e. Fire-Resistance Rating: As indicated on Drawings.
- 3. Type: Snap-on cover.
 - a. Metal: Aluminum.
 - 1) Finish: Manufacturer's standard.
- H. Ceiling-to-Ceiling:
 - 1. Basis-of-Design Product: Construction Specialties, Inc.; Model as indicated on Drawings.
 - 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: As indicated on Drawings.
 - e. Fire-Resistance Rating: As indicated on Drawings.
 - 3. Type: Snap-on cover.
 - a. Metal: Aluminum.
 - 1) Finish: Manufacturer's standard.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 - 1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
 - 2. Balco, Inc.
 - 3. Construction Specialties, Inc.
 - 4. JointMaster/InPro Corporation.
 - 5. MM Systems Corporation.
 - 6. Nystrom, Inc.
 - 7. Schul International Company, Inc.
 - 8. Tremco Incorporated.
 - 9. Williams Products, Inc.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Wall-to-Wall:
 - 1. Basis-of-Design Product: EMSEAL; Seismic Colorseal.
 - 2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: Seismic.
 3. Type: Preformed cellular foam.
 - a. Foam Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
 - D. Wall Corner:
 1. Basis-of-Design Product: EMSEAL; Seismic Colorseal.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 - d. Type of Movement: Seismic.
 3. Type: Preformed cellular foam.
 - a. Foam Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- 2.5 MATERIALS
- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 - B. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
 - C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.
 - D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 - E. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.
- C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 - 5. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Foam Seals: Install with adhesive recommended by manufacturer.
- D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
 - 1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Flush Wood Doors".
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
8. Division 28 Section "Access Control Hardware".
9. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.

6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. 10. SDI-113 Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door & Frame Assemblies.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM C1199 - Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
12. ASTM E1423 - Practice for Determining Steady State Thermal Transmittance of Fenestration Systems.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
17. FEMA P-361 2015/2021 - Design and Construction Guidance for Community Safe Rooms.
18. ICC 500 - 2014/2020 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
19. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
20. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
21. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.
- C. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- D. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.

5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

E. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. 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 according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) 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.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier,

Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (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 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. 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. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
 - 3. Core Construction: Manufacturer's standard polyurethane. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 3.2 or better.
 - 4. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. 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. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Manufacturers Basis of Design:
1. CECO Door Products (C) Polystyrene Core - Legion Series.

2.4 HOLLOW METAL DOOR AND SHUTTER ASSEMBLIES FOR STORM SHELTERS

- A. General: Provide complete tornado or hurricane storm shelter resistant assemblies constructed, test, and listed/labeled to resist the design pressures for components and cladding and missile impact resistance as described in ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
1. Door and shutter systems, tested and complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
 2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.
 3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
6. Replaceable Glass System: Provide a field replaceable glass system certified to UL10C and ICC 500 2014 and 2020. Glass shall be McGroby Glass FireDefend SD36-F90, 2-3/16" thick available in 10" x 10" or 4" x 25" sizes fire rated up to 90-minutes with a 227 psf design pressure for hurricane and 284 psf design pressure for tornado openings and a 15 lb. 2 x 4 at 100mph impact resistance.

B. Manufacturers Basis of Design:

1. CECO Door Products (C) - StormPro Series.
2. Curries Company (CU) - StormPro Series.

2.5 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. CECO Door Products (C) - SU SR Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. CECO Door Products (C) - SU Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAMES FOR STORM SHELTERS

A. General: Subject to the same compliance standards and requirements as standard hollow metal frames, provide complete tornado or hurricane storm shelter resistant assemblies tested and labeled as complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021) and supported by third party test listings.

1. Fabricate exterior frames from 14 gauge hot dipped zinc coated steel that complying with ASTM designations A924 A60.
2. Manufacturers Basis of Design:

- a. CECO Door Products (C) - StormPro Series.
- b. Curries Company (CU) - StormPro Series.

2.7 FRAME ANCHORS

A. Jamb Anchors:

- 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, 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 and not less than 0.042 inch thick.
- 3. Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors as per manufacturers listing or anchor detail sheets including welded installation methods.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

- 1. Blade Type: Vision proof inverted V or inverted Y.
- 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

- 1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
- 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.9 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.10 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.11 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar 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.
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
5. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. 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 on-center and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 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) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
8. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
9. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 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 non-template, 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 26 Sections.

2.12 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. 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.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 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. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top or bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 2. Warranty Period for Solid-Core Interior Doors: Life of installation.

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. Algoma Hardwoods, Inc.
 2. Chappell Door Co.
 3. CraftMaster Interior Doors.

4. Eggers Industries.
5. Graham; an Assa Abloy Group company.
6. Mainman Company (The).
7. Marshfield Door Systems, Inc.
8. Mohawk Flush Doors, Inc.; a Masonite company.
9. VT Industries Inc.

- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. WDMA I.S.1-A Performance Grade: Heavy Duty.

- B. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

- a. Screw Withdrawal, Face: 700 lbf.
- b. Screw Withdrawal, Edge: 400 lbf.

- C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide formed-steel edges and astragals.
 - a. Finish steel edges and astragals to match door hardware (locksets or exit devices).

- D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - a. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
2. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:

1. Grade: Premium (Grade A faces).
2. Species: White Oak.
3. Cut: Plain sliced (flat sliced).

4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
8. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
9. Core: Structural composite lumber.
10. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
11. Door Thickness: 1-3/4 inch.
12. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 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 Section 088000 "Glazing."

2.5 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 bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane, or WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin unless indicated otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "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 according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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SECTION 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA252 or UL10B for fire-rated access door assemblies installed vertically.

2.2 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTMA36/A36M.
 - 1. ASTMA123/A123M, for galvanizing steel and iron products.
 - 2. ASTMA153/A153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTMA591/A591M with cold-rolled steel sheet substrate complying with ASTMA1008/A1008M, Commercial Steel (CS), exposed.
- C. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 ACCESS DOORS AND FRAMES

- 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. Babcock-Davis.
 - 2. J. L. Industries, Inc.
 - 3. Karp Associates, Inc.
 - 4. Larsen's Manufacturing Company.
 - 5. Milcor Inc.
 - 6. Nystrom, Inc.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Exposed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As indicated.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Hinges: Manufacturer's standard.
 - 7. Hardware: Lock.
- D. Flush Access Doors with Concealed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As indicated.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.

5. Frame Material: Same material and thickness as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

E. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
5. Frame Material: Nominal 0.060 inch, 16 gage, same material and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

F. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Wall and ceiling.
3. Fire-Resistance Rating: Not less than that of adjacent construction.
4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
5. Frame Material: Nominal 0.060 inch, 16 gage, same material and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

G. Hardware:

1. Latch: Cam latch operated by screwdriver.
2. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

H. Hardware: Stainless steel hinges with removable pin, screw driver slot with quarter turn cam lock, except for fire rated access doors.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTMA879/A879M, with cold-rolled steel sheet substrate complying with ASTMA1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTMA153/A153M or ASTM F2329.

2.5 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 in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- 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.
 - 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.6 ACCESS DOOR SIZE

- A. Minimum Size: 24-inch by 32-inch for any items to be accessed requiring shoulders to fit through access door opening.
- B. Provide 32-inch by 40-inch doors in 6-inch thick or thicker block or stud walls.
- C. Provide 16-inch by 16-inch doors at locations where item to be accessed is entirely accessible and convenient to work on within 8-inches of access door face of wall or ceiling.
- D. Where access doors are required to accommodate filters or similar replacement/maintenance equipment, doors shall be of size to pass 1.25 percent of the least equipment dimension.
- E. Other sizes as indicated in the Construction Documents.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 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 083113

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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.
- B. Reference Drawing A601, Door Schedule.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior storefront framing.
 - 2. Interior manual-swing entrance doors and door-frame units.
 - 3. Fire Resistive Door and Window Framing System.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

- C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Delegated-Design Submittal: For aluminum-framed storefronts 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. Qualification Data: For Installer.
- B. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.
- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.8 WARRANTY

- A. Special 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 fail in materials or workmanship 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. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Finish Warranty: Include coverage for aluminum finishes degradation.
 - 1. Clear Anodized Finish: Provide a five year manufacturer's warranty.
- C. Glass Warranty: As specified in Section 088000.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer registered in the state where the project is located, as defined in Section 014100 "Regulatory Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings
2. Seismic Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection 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.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural-Test Performance: Provide aluminum-framed 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 fewer than 10 seconds.
- Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.40 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 68 as determined according to NFRC 500.
- I. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum 27.
- J. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 3. Interior Ambient-Air Temperature: 75 deg F

2.2 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide YKK YES 45 TU series storefront framing system, or comparable product by one of the following:
1. EFCO Corporation.
 2. Kawneer North America.
 3. TRACO.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 INTERIOR FRAMING SYSTEM

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Non-Thermal.
 - 2. Glazing System: Retained mechanically with gaskets.
 - 3. Glazing Plane: Center rabbet, exterior flush glazed.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. 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.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 FIRE-RESISTIVE FRAMING SYSTEM

- A. Basis-of-Design Products: Subject to compliance with requirements, provide SaftiFire GPX 300 Series framing system manufactured by SAFTI *FIRST* Fire Rated Glazing Solutions.
- B. Frame Thickness: 3 to 5 inches.
- C. Internal Framing: Internal tube steel framing will conform to ASTM A501. Formed steel retainers to be galvanized conforming to ASTM A527.
- D. Insulation: The framing system will insulate against the effects of fire, smoke and heat transfer from either side. The perimeter of the framing system to the rough opening will be firmly packed with mineral wool fire stop insulation or appropriately rated intumescent sealant.
- E. Fasteners: As recommended by framing manufacturer.
- F. Framing Covers: Powder coated extruded aluminum alloy 6063-T5 or aluminum alloy 5052 when anodized.
- G. Glass for Fire-Resistive Assemblies: Glazing will be SuperLite glazing products. If assembly is required to meet ASTM E 119, SuperLite II-XL will be used
- H. Glazing Accessories: The glazing material perimeter will be separated from the perimeter framing system with approved flame retardant glazing tape. The SuperLite glazing panel will be caulked continuously around the edge to the tube steel frame utilizing neutral cure silicone.

2.5 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.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - 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.

2.6 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 2-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Wide stile; 5-inch nominal width door stiles with 10 inch bottom rail (See dwg. A601).
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 - 3. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets to match adjacent storefront construction.
 - a. Provide non-removable glazing stops on outside of door.

2.7 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.8 GLAZING

- A. Glazing: As specified in Division 08 Section "Glazing."

- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.9 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
- C. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.10 FABRICATION

- A. Form or extruded 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 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 exterior.
 - 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. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, 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. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. 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 applying sealant or tape, or by 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. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Division 08 Section "Glazing."
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install weatherseal sealant as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.5 DOOR HARDWARE FOR FIRE RESISTIVE DOORS

- A. Hinges: OKC continuous geared type manufactured by Pemco.
- B. Panic Device: Model 9827F with 996 L trim manufactured by Von Duprin.
- C. Closer: Model 4041 manufactured by LCN.
- D. Automatic Door Bottoms: Model 420APKL manufactured by Pemco.

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SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

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 aluminum tube framing system with vision glass (refer to Section 8 "Glazing") and manual swing exterior storefront doors.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.

- D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- E. Delegated-Design Submittal: For glazed aluminum curtain walls 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. Qualification Data: For Installer and laboratory mockup testing agency.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Sample Warranties: For special warranties

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Preparation of data for glazed aluminum curtain-wall systems including the following:
 - a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to glazed aluminum curtain-wall systems including, but not limited to, the following:
1. Review structural load limitations.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review required testing, inspecting, and certifying procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain-wall 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. Water leakage.
 - e. Failure of operating components to function normally.
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Finish Warranty: Include coverage for aluminum finishes degradation.
1. Clear Anodized Finish: Provide a five year manufacturer's warranty.
- C. Glass Warranty: As specified in Division 08 - Glazing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $1/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller.
- E. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:

- a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- J. Energy Performance: Certify and label energy performance according to AAMA 1503 and AAMA 507 as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.46 Btu/sq. ft. x h x deg F.
 2. Condensation Resistance: Fixed glazing and framing areas shall have a condensation resistance rating of no less than 66.
- K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide YCW 750 System as manufactured YKK AP America Inc. or comparable product by one of the following:
1. Kawneer North America.
 2. TRACO.
- B. Source Limitations: Obtain all components of curtain wall system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally improved.
 2. Glazing System: Retained mechanically with gaskets on four sides.

3. Glazing Plane: Front.
4. Finish: Clear Anodic Finish (Coordinate with Storefront System)
5. Fabrication Method: Field-fabricated stick system.

B. Framing Dimensions:

1. Face Dimension: 2-1/2 inches.
2. Depth: 6 inches

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

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

E. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 SUN SHADES

A. YKK AP Series ThermaShade® Aluminum Sun Shade System.

B. Sun Shade System:

1. Description: All structural components and attachment hardware shall be concealed.
2. Thermally improved anchor: Sunshade anchor must provide a continuous thermal barrier by means of a poured and debridged pocket consisting of a two-part, chemically curing high density polyurethane which is bonded to the aluminum by YKK AP ThermaBond Plus™. Anchors employing non-structural thermal barriers are not acceptable.

3. Materials

- a. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 and 6063-T6 Aluminum Alloys.
- b. Aluminum Plate:
 - 1. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.25" (6.35 mm) nominal thickness.
- c. Finish: Clear Anodized (match Curtain Wall).

2.5 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Curtain wall manufacturer's standard types to suit application to achieve weather, moisture, and air infiltration requirements.
- C. Glazing Sealants: As recommended by manufacturer for joint type.

2.6 DOOR UNITS

- A. Entrance Doors: YKK AP America, Inc. Model 50D Wide Stile glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 2-inch overall thickness, with extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Wide stile; 5- inch nominal width door stiles with 10 inch bottom rail.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 - 3. Glazing Stops and Gaskets: Snap-in, extruded-aluminum stops and preformed gaskets to match adjacent storefront construction.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.7 INSULATION

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Thermax White Finish Insulation, or comparable product by one of the following:
 - 1. Rmax, Inc.
 - 2. Dow Chemical Co.
 - 3. Hunter Panels.

- B. Thickness: Two inches.

2.8 ACCESSORY MATERIALS

- A. Perimeter Fire-Containment Systems (Safing Insulation): Specified in Division 07 Section "Thermal Insulation."
- B. Insulating Materials: Specified in Division 07 Section "Thermal Insulation."
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- D. Limit Stops: Provide limit stops at all window openings. Manufacturer's standard opening height.

2.9 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Sharp profiles, straight and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other 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 prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
 - 6. Provisions for reglazing from interior for vision glass and exterior for spandrel glazing or panels.
- C. Fabrication Tolerances:
 - 1. Material Cuts: Square to 1/32 inch off square, maximum, over largest dimension; proportionate amount of 1/32 inch on other two dimensions.
 - 2. Maximum Offset: 1/64 inch in alignment between two consecutive members in line, end to end.
 - 3. Maximum Offset: 1/64 inch between framing members at glazing pocket corners.
 - 4. Joints (Between adjacent members in same assembly): Hairline and square to adjacent member.
 - 5. Variation (In squaring diagonals for doors and fabricated assemblies): 1/16 inch.
 - 6. Flatness (For doors and fabricated assemblies): +/- 1/16 inch off neutral plane.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. 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. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified Division 08 Section "Glazing."
- G. Install sealants as specified in Division 07 Section "Joint Sealants."
- H. Install insulation materials as specified in Division 07 Section "Thermal Insulation."
- I. Install perimeter fire-containment systems (safing insulation) as specified in Division 07 Section "Thermal Insulation."
- J. Erection Tolerances: Install glazed aluminum curtain-wall systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or greater, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Inspection to monitor quality of installation and glazing.
 1. Curtain wall and glass product manufacturers to provide field surveillance of the installation of their Products.
 2. Monitor and report installation procedures and unacceptable conditions.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum uniform and cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.
 3. Water Spray Test: After the installation of minimum area of 75-feet- by-2-story glazed aluminum curtain-wall system has been completed but before installation of interior finishes has begun, a 2-bay area of system designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 4. Perform one test each at 10%, 50% and 80% of curtain wall completion, with repeat tests when failures occur.
- D. Remove and replace non-complying aluminum curtainwall and/or perform acceptable corrective/remedial work to windows where test results indicate that do not comply with the specified performance requirements and retest failed units as specified above. Retesting will be performed at contractor's expense.
 1. Upon successful completion of retesting the corrective/remedial work performed is required to be performed at all similar window/curtainwall types and locations and at least one (1) additional window/curtainwall unit/location of the same type/configuration is to be tested at the contractor's expense.

- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements at the failed test location.

3.4 Schedule of locations for Glazed Aluminum Curtain Walls

A. Reference Drawing A602, Exterior Frames

- 1. CW1
- 2. CW3
- 3. CW4A
- 4. CW4B
- 5. CW5
- 6. CW9
- 7. CW10
- 8. CW12.

END OF SECTION 084413

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SECTION 084414 – SECURITY GLAZED ALUMINUM CURTAIN WALLS

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. “Large Missile Impact” Aluminum Curtainwall System
- B. Related Sections
 - 1. Division 5 Section “Structural Steel” for steel support lintels.
 - 2. Division 7 Section “Joint Sealants” for joint sealants.
 - 3. Division 8 Section “Aluminum Framed Entrances and Storefronts” for aluminum doors, frames, and storefront framing to interface with work of this Section.
 - 4. Division 8, Section “Glazed Aluminum Curtain Walls” for non-security aluminum frame curtain walls.
 - 5. Division 8 Section “Security Glazing”, Requirements and types of glass installed under this Section.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36 – Structural Steel.
 - 2. ASTM A386 – Zinc Coating (Hot-Dip) on Assembled Steel Products.
 - 3. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
 - 4. ASTM B209 - Aluminum-Alloy Sheet and Plate.
 - 5. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire Shapes and Tubes.
 - 6. ASTM E283 - Rate of Air Leakage Through Windows.
 - 7. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Differential.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 605.1 - Voluntary Specification for High Performance Coatings on Architectural Extrusions and Panels.
- C. Federal Specifications (FS):
 - 1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid-Resistant.

1.4 DEFINITIONS

- A. Water Leakage: Appearance of water, other than condensation, on room side of any part of assembly offering protection from exterior elements to interior building space.
- B. Manufactured Curtain Walls: Fenestration that is factory-assembled as a unit, and tested and labeled by the manufacturer.

1.5 DESIGN REQUIREMENTS

- A. General:
 - 1. Work specified in this Section is related to other Work, indicated as follows, which together comprise exterior finish of building. Completion of Work specified in these sections shall result in complete structurally sound and weather proof exterior building enclosure. Omissions, contradictions, duplications, or other irregularities in these Sections that may preclude overall performance outlined shall be noted in writing for Architect's interpretation.
 - a. Unit masonry
 - b. Stone masonry veneer
 - c. Metal wall panels.
 - d. Joint sealants.
 - e. Aluminum entrances and storefronts.
 - f. Glazing.
 - 2. Provide manufacturer's stock glazed aluminum curtain wall system adapted to application indicated or custom designed system that complies with performance requirements specified, as demonstrated by testing manufacturers corresponding stock systems according to test methods specified.
- B. Provide system having the following capabilities:
 - 1. Sections of typical members, dimensioned elevations, frame sizes, spacing of anchors and fasteners, and details of accessories.
 - 2. Glazing physically and thermally isolated from framing members.
 - a. Air infiltration and water penetration exceeding specified limits.
 - b. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
 - 3. Except for spandrel glazing or panels, system is reglazable from interior.
- C. Supplementary Parts: Size, design, and provide wall sections and anchor assemblies to meet design and performance requirements, including inserts, fasteners, clips, bracing, and steel framework as required, even if not indicated, for proper anchorage of elements to structure.
 - 1. Such items indicated are schematic and do not necessarily indicate exact required scope, type, shape, or profile. Add or modify indicated anchorage and structural support framing as required.
 - 2. Anchorage and structural supports shall not spall or weaken integrity of building elements to which attached. Repair damaged coatings after weldment.

- D. Adjustments: Subject to Architect's approval, make adjustments in thickness, dimension, and profile of proposed system to facilitate fabrication or erection methods or techniques, weatherability factor, or design and performance requirements. Design is limited only to dimensional space allowed for curtain wall system and by capacity of system to meet or exceed design and performance requirements specified.
- E. Brace point of support for assemblies in 3 orthogonal directions (vertical, transverse, and longitudinal) to resist loads from all directions.
 - 1. Bracing shall not be laterally supported to bottom flanges of structural framing.
- F. Control of Corrosion: Prevent galvanic and other forms of corrosion by insulating metals and other materials from direct contact with non-compatible materials.

1.6 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
 - 3. This project has been designed for occupancy as a storm shelter. The Work identified in this Section is a component of that security occupancy as follows:
 - a. Type of Shelter: Hurricane
 - 4. Shelter Design Wind Speeds:
 - a. Hurricane 190 MPH
- B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for buildings and Other Structures: Section 6.0 "Wind Loads."
- D. Structural-Test Performance: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
 3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- F. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 and shall comply with FEMA 361 and ICC 500 for "Shelter Protection".
- G. Story Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
- H. Pressure Testing:
1. FEMA 361 Compliant: Pass static pressure tests and cyclic tests according to FEMA 361/ICC 500-20014 in accordance with:
 - a. ASTM E330 - Standard Test Method For Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - b. ASTM E 1886 - Standard Test Method For Performance Of Exterior Windows, Curtain Walls, Doors And Impact Protective Systems Impacted By Missiles and Exposed To Cyclic Pressure Differentials
- I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Test Interior Ambient-Air Temperature: 75 deg F.
 3. Retain subparagraph below if testing is required for Project. Standard glazed aluminum curtain walls are usually not tested according to AAMA 501.5. Manufacturers often rely on calculations and in-service
- J. Energy Performance:

1. Manufactured Curtain Walls: Certified and labeled by manufacturer for energy performance ratings in accordance with NFRC.
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have Ufactor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 102.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC200.
 - c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft.of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRCcertified condensation resistance rating of no less than 6045 as determined according to NFRC 102.
 - K. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
 1. Outdoor-Indoor Transmission Class: Minimum 26 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
 - L. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- 1.7 SUBMITTALS
- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - B. Proposal Documents: Submit following with bid, sealed and signed by structural engineer who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices.
 1. Proposal Drawings indicating typical details of curtain wall systems. Proposal Drawings shall be prepared under direct supervision of structural engineer responsible for preparation of preliminary calculations.
 2. Preliminary calculations indicating compliance with specified structural performance criteria. Preliminary calculations shall be prepared by structural engineer who will be responsible for preparation of shop drawings and engineering analysis.
 3. List of minimum of 3 projects completed within past 3 years of similar scope and complexity. Include names of contact with owner, architect, and contractor for each listed project.

- C. Shop Drawings: Sealed and signed by structural engineer responsible for preparation of engineering analysis who thereby certifies preparing or supervising preparation of data to comply with specified requirements and recognized engineering principles and practices. Shop Drawings include, but are not limited to:
1. Plans, elevations, sections, and details for fabrication and installation of system indicating sizes, dimensions, sections, and profiles; arrangement and provisions for jointing, supporting, anchoring, and fastening.
 2. Include details showing relationship with, attachment to, and reception of related Work.
 - a. Indicate details of adjoining Work, even though not included in Work of this Section, to ensure coordination of Work and Work of other Sections.
 - b. Indicate paths of moisture travel.
 - c. Include descriptions of movement and tolerances of related building and wall components including direction and magnitude or thermal, building, movements; materials, sizes, quantities, and special instructions as required.
 - d. Schedule and describe anchorage assemblies and their related components.
 - e. Include data for capacity of each type of fastener for its intended use.
 - f. Show location of inserts for anchors and supports which are to be attached to structure or built into concrete or masonry, if any.
 - g. Reference Architect detail numbers where applicable.
- D. Engineering Analysis: Sealed and signed by structural engineer who thereby certifies preparing or supervision preparation of data to comply with specified requirements and recognized engineering principles and practices:
1. Include computations for justification of framing elements or sections, connections including fasteners and welds, anchorage assemblies, and the like, in static and dynamic modes.
 2. Calculate anchor clips with slotted holes in most extended condition.
 3. Dimensionally limit stacking of shims in regards to bending on bolts, clips, fasteners, and the like.
- E. Glass Manufacturer's Approval: Submit letter, prior to submission of Shop Drawings, that authorized representative of selected glass manufacturer has reviewed and approved details including glass bite, support, clearances, system weepage, air circulation around interior window treatments, shading by exterior building components, and glazing methods.
- F. Requirements of Regulatory Agency: Submit Shop Drawings and engineering analysis to agencies having jurisdiction for plan check and permit.
1. Additional charges or permit fees will be paid by Owner.
 - a. Review modifications required by agencies with Architect for architectural conformance with aesthetic design indicated before revising shop drawings and engineering analysis and securing permit.
- G. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

- H. Qualification Data: For qualified Installer and testing agency.
- I. Welding certificates.
- J. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
- K. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- L. Preconstruction Test Reports: For glazed curtain walls and elastomeric glazing sealants.
- M. Quality-Control Program: Developed specifically for Project, including fabrication and installation of glazed curtain wall assemblies, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- N. Source quality-control reports for structural-sealant-glazed curtain wall assemblies.
- O. Field quality-control reports.
- P. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals. Include ASTM 1401 recommendations for post-installation-phase quality-control program for structural-sealant-glazed curtain wall.
- Q. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Performance Documents:
 - 1. This performance specification is issued in conjunction with contract Drawings which indicate general arrangement of Work, dimensions, structural system, and major architectural elements of construction.
 - 2. As performance documents, Drawings and Specifications do not necessarily indicate or describe all items required for full performance and completion of Work which includes labor, materials, equipment and services, all as required for complete design, approval, fabrication, assembly, delivery, anchorage, erection, and weather proofing of glazed aluminum curtain wall system and related items as detailed, specified, and as required by job conditions.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
- C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project and who is capable of assuming engineering responsibility as follows:

1. Preparation of data for glazed aluminum curtain wall systems including, but not limited to:
 - a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- D. Field Quality Control Testing Agency Qualifications: An independent agency qualified according to requirements of Section 01400 "Quality Control Testing Services" and with ASTM E 699 for testing indicated.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including field testing, and in-service performance.
 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D 1.2/D1.2M, "Structural Welding Code - Aluminum."
- G. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.
- H. Mockups: Build mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Field testing shall be performed on mockup according to requirements of 3.4 - "Field Quality Control."
 2. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to glazed aluminum curtain wall system including, but not limited to:
 1. Review structural load limitations.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review required testing, inspecting, and certifying procedures.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying Work, establish dimensions and proceed with fabricating glazed aluminum curtain wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship 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 created by wind and thermal and structural movements.
 - c. Failure of system to meet performance requirements.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - e. Water penetration through fixed glazing and framing areas.
 - f. Failure of operating components to function normally.
 - g. Glass breakage.
 - h. Corrosion of fasteners.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Survivalite, Baton Rouge, LA, 5000 Series at glazed aluminum curtain wall assembly and entrance doors where indicated on the drawings, or comparable product by one of the following:
 1. FEMA 361 Compliant Glazed Aluminum Curtain Wall Assembly:
 - a. Insulguard.
 - b. West Tampa Glass

2.2 MATERIALS

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

1. Aluminum extrusions shall be 6063-T5 for trim and 6063-T6 or 6005-T5 for structural shapes, unless otherwise noted.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPCSP COM and prepare surfaces according to applicable SSPC standard.
 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

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Thermally improved.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
- 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. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners only where specifically indicated on accepted Shop Drawings. Where allowed, use countersunk Phillips screw heads, finished to match framing system.
 4. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.
- D. Anchors: Anchor edge distance and embedment to be per manufacturer details. Any deviation from minimums shown must be approved by Engineer.
 1. Unless noted otherwise, frame assembly fasteners to be stainless steel; ANSI type (18-8).
 2. Non-exposed carbon steel bolts, if required, shall have zinc plating, T6.
 3. Concrete anchors to be carbon steel stalgard coated tapcons (or approved otherwise).
- E. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- F. Framing Sealants: Manufacturer's standard sealants with VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA method 24).

2.4 GLAZING

- A. Glazing: Comply with Division 08 Section "Security Glazing."
- B. Glazing Gaskets:
 - 1. Glass setting blocks to be dense EDPM having a shore "A" hardness of 85 ± 5 durometer at $\frac{1}{4}$ points of glass width. Length shall be 6" (min).
- C. Glazing Sealants for Glazed Aluminum Curtain Walls: As recommended by manufacturer.
 - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 ACCESSORY MATERIALS

- A. Shims shall be full bearing high impact polystyrene.

2.6 FABRICATION

- A. Form or extrude 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. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles which are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 6. Provisions for field replacement of glazing from interior
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components that, when assembled, have the following characteristics:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- E. Factory- Assembled Units for Glazed Curtain Walls:
 - 1. Rigidly secure nonmovement joints.
 - 2. Seal joints watertight unless otherwise indicated.
 - 3. Install glazing to comply with requirements in Division 08 Section "Glazing."

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

2.7 SOURCE QUALITY CONTROL

- A. Perform quality control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

2.8 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Components shall be fully formed and fabricated prior to finishing. Exposed surfaces shall receive specified finish with no mill finish aluminum exposed unless otherwise indicated.
 - 2. Appearance of Finished work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of accepted Samples and are assembled or installed to minimize contrast, subject to Architect's approval.
 - 3. Exercise extreme care to protect finishes during manufacture and installation. Damaged elements will be rejected by Architect. Touch-up procedures which do not meet finish requirements specified are not permitted.
- B. Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.
- C. Clear Anodic Finish: AAMA 611, AA-MI2C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, 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. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. 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 glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Division 08 Section "Glazing." Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with following nonaccumulating maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1 1/2 inch over total length.

B. Glass Breakage During Construction: Replace glass breakage resulting from execution of Work.

1. Protect openings caused by breakage immediately.
2. Replace broken glass within 5 calendar days.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of glazed aluminum curtain walls shall take place on mockup to determine compliance of installed assemblies with specified requirements.
 - 1. Air Infiltration and Water Penetration Testing: FEMA 361 Compliant: Pass static pressure tests and cyclic tests according to FEMA 361/ICC 500-20014 in accordance with:
 - a. ASTM E330 - Standard Test Method For Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - b. ASTM E1886 - Standard Test Method For Performance Of Exterior Windows, Curtain Walls, Doors And Impact Protective Systems Impacted By Missiles and Exposed To Cyclic Pressure Differentials
- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 CLEANING

- A. Remove debris caused by or incidental to installation as Work progresses.
- B. Remove dirt, rubbish, and sealants from weep holes and drainage channels.
- C. Remove protective coverings from exposed surfaces, and clean surfaces of soil and discoloration.
 - 1. Cleaners shall be acceptable to aluminum, glass, sealant, gasket, and aluminum finishing manufacturers. Where doubt exists, make spot tests.

3.6 PROTECTION

- A. Provide final protection and maintain conditions, in manner acceptable to manufacturer and Installer, which ensures curtain wall system is without damage or deterioration at time of Substantial Completion.

END OF SECTION 084414

SECTION 085653 – IMPACT AND SECURITY WINDOWS

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. Impact, wind, and bullet resistant aluminum security windows

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, materials, individual components profiles, maintenance data, and finishes, including all accessories listed in this section.
 - 2. Product Certificates:
 - a. Indicating compliance with ICC 500 2020 and FEMA P-361 requirements
 - b. UL 752 Level 3
- B. Qualification Data: For installer and testing agency.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation for each type of substrate.
- D. Samples: For each exposed material, at least 3 by 5 inches in size, in specified finish.
- E. Product Schedule: Provide complete schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- F. Warranty: Sample of finish and glass warranty.

1.4 WARRANTY

- A. Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for the period of 10 years from the date of substantial completion.
- B. Glass Warranty: manufacturer's warranty against defects in material and workmanship resulting in edge separation or delamination for a period of 5 years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Windows are a part of the secured area of the facility.
- B. Wind design speed requirements as indicated on drawings.
- C. Debris Hazard Compliant Design:
 - 1. FEMA P-36-21/ ICC 500-2020 compliant for Debris Hazards: Pass missile-impact tests.
 - a. ASTM E1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems impacted by missiles and exposed to cyclic pressure differentials.
 - b. ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems impacted by windborne debris in hurricanes.
 - 2. Tornado: Resists impact of a 15 pound 2x4 at 90 MPH for vertical surfaces and 60 MPH for horizontal surfaces.
 - 3. Hurricane: Resists impact of a 9 pound 2x4 at [designed wind speed x .5 factor].
- D. Pressure Testing:
 - 1. FEMA P-361-2021/ ICC 500-2020 compliant: Pass static pressure tests and cyclic tests.
 - a. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by uniform static air pressure difference.
 - b. ASTM E1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems impacted by missiles and exposed to cyclic pressure differentials.
 - 2. Ballistic Resistance: Level 3 in accordance with UL 752 – Standard for Bullet-Resisting Equipment.
 - 3. Energy Performance:
 - a. Thermal Transmittance: (U-factor): Fixed glazing and framing areas shall have U-factor of not more than .32.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than .45 as determined according to NFRC 200.

2.2 FRAMING

A. Basis of Design: Insulgard STORMDEFEND TTH600 Tornado and Hurricane Storm Shelter Window System.

1. Subject to compliance with requirements, manufacturers of products of equivalent design may be acceptable.

B. Description

1. Factory fabricated framing constructed from either 6005-T5 or 6015-T5 extruded aluminum with integral weep design to allow water to bent to exterior along horizontal members. Thermal separation of frame using plyamide strip.
2. Dimensions:
 - a. Head, jamb, and sill members: 2 ½ inches by 6 inches.
 - b. Mullion and intermediate horizontal members: 3 ¼ inch face.
3. Unit to be permanently marked with certification label of the certified testing agency acceptable to the authorities having jurisdiction. Label to include:
 - a. Design Pressure
 - b. Tested Pressure
 - c. Missile Criteria
 - d. ICC-500 (2020) Certification Listing

2.3 GLAZING

A. Basis of Design: TOR_GARD 30 IG

1. Subject to compliance with requirements, manufacturers of products of equivalent design may be acceptable.

B. Glazing Material: Insulating Glass Clad Polycarbonate

1. Wind, Impact, and Level 3 Ballistic Resistant Glazing

2.4 FABRICATION TOLERANCES

- A. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.

2.5 FRAMING FINISH

A. Factory-applied finish:

1. Clear Anodic Finish: Architectural Class 1, clear coating AA-M10C22A41
Chemical Finish: etched, medium matte; 0.70 mils minimum complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum"

2.6 ACCESSORIES

- A. Anchors: fully concealed in accordance with performance requirements.

- B. Glazing Gaskets: manufacturer supplied EPDM gasket utilized as a component of the tested assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify field dimensions of opening prior to fabrication of windows.
- C. Coordinate structural requirements to ensure proper attachment and support.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's recommendations and approved shop drawings.
- B. Provide required support and securely fasten and set windows plumb, square, and level without twist or bow.
- C. Apply sealant in accordance with window and sealant manufacturer's recommendations as indicated in installation instructions. Wipe off excess, and leave exposed sealant surfaces clean and smooth.
- D. Protect windows from damage during construction operations, including breakage, crazing, cracking, fissures, dents, delamination, scratches, or other deformations. If damage occurs, remove and replace as required to provide windows in their original, undamaged condition.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace frames that are warped, bowed, or otherwise damaged.
- B. Clean in accordance with manufacturer's recommended cleaning procedures using recommended cleaning agents. Polycarbonate can be adversely affected by chemicals that should only be used on glass. Use of incompatible projects may void the warranty.

END OF SECTION 085653

SECTION 087100 - DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
- C. Related Sections:
 - 1. Division 08 Section "Operations and Maintenance".
 - 2. Division 08 Section "Door Schedule".
 - 3. Division 08 Section "Door Hardware Schedule".
 - 4. Division 08 Section "Hollow Metal Doors and Frames".
 - 5. Division 08 Section "Interior Aluminum Doors and Frames".
 - 6. Division 08 Section "Flush Wood Doors".
 - 7. Division 08 Section "Blast Resistant Doors".
 - 8. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 9. Division 08 Section "Fire-Rated Steel Framed Entrances."
 - 10. Division 26 Section "Electrical"
 - 11. Division 28 Section "Integrated Access Control Hardware Devices".
 - 12. Division 28 Section "Intercom Entry Systems".
- D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. FEMA P-361 2015/2021 - Design and Construction Guidance for Community Safe Rooms.
 - 3. ICC 500-2014/2020, ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 4. ICC/IBC - International Building Code.
 - 5. NFPA 70 - National Electrical Code.
 - 6. NFPA 80 - Fire Doors and Windows.
 - 7. NFPA 101 - Life Safety Code.

8. NFPA 105 - Installation of Smoke Door Assemblies.
9. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Storm Shelter Impact Protective Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Storm Shelter Impact Protective assembly hardware applied to the opening.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
- H. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.

- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- K. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Storm Shelter Openings: Furnish a complete set of operational and maintenance instructions as needed for Owner's continued adjustment, maintenance, and repairs of door hardware as required by ICC 500 (2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door

Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.3 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge

pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

- a. Hager Companies (HA) - BB Series, 5-knuckle.
- b. McKinney (MK) - TA/T4A Series, 5-knuckle.
- c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

B. Hinges at Storm Shelter Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.

1. Quantity: Provide the following hinge quantity:

- a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.
- b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.

2. Quantity: Provide the following hinge quantity:

- a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.
- b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.
- c. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
- d. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
- e. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
- b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

4. Hinge Weight and Base Material: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a certified Storm Shelter Opening meeting ICC 500.

5. Manufacturers:

- a. McKinney (MK) - SP3386/SP3786.
- b. No Substitution.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves

and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:
 - a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
 - a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
 - a. Rockwood (RO).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
 6. Manufacturers:
 - a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
 - a. Sargent Manufacturing (SA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Manufacturer's Standard.
- C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
 2. Manufacturers:
 - a. Sargent (SA) - Degree DG1.
 - b. No Substitution.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide construction master keyed cylinders.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.9 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Heavy duty 12-gauge wrought steel case.
 - b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1" projection deadbolt.
 - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - d. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
 - e. Status indicators inside, outside, or on both sides of doors as specified; available with wording for "locked/unlocked", "vacant/occupied" or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
 - f. Ten-year limited warranty for mechanical functions.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Schlage (SC) - L9000 Series.

2.10 MULTI-POINT LOCKS AND LATCHING DEVICES

- A. Multi-Point Locksets, Storm Shelter: Provide ANSI/BHMA A156.37, Series 1000, Operational Grade 1 and Security Grade 1 Certified Products Directory (CPD) listed multi-point locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - FE6600 Series.
- b. Sargent Manufacturing (SA) - FM7300 Series.
- c. Schlage (SC) - LM9300.
- d. No Substitution.

2.1 INTEGRATED WIRED OUTPUT LOCKING DEVICES - MULTI-CLASS READER

- A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
- 1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
 - 2. Integrated reader supports the following credentials:
 - a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
 - b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
 - c. 2.4 GHZ credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
 - d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
 - e. NFC-enabled mobile phones
 - f. PIN code only or PIN + credential with keypad option.
 - 3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
 - 4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 - 5. Support end-of-line resistors contained within the lock case.
 - 6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 - 7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
 - 8. Manufacturers:
 - a. Corbin Russwin (RU) - ML2000 SN Series.
 - b. Sargent Manufacturing (SA) - SN200/SN210 8200 Series.

- B. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

2.2 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.3 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

- a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 - 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 - 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 - 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 - 12. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
- 1. Provide exit devices with functions and features as follows:
 - a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - b. No catch points: addition of applied deflectors or other added components are not allowed.
 - c. No visible plastic.
 - d. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
 - e. Constructed of all stainless steel.
 - f. Stainless steel pullman type latch with deadlock feature.
 - g. Narrow or wide style exterior trim as specified in the hardware sets.
 - h. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
 - i. Ten-year limited warranty for mechanical features.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - PED4000 / PED5000 Series.
 - b. Sargent Manufacturing (SA) - PE80 Series.
- C. Multi-Point Exit Devices (Storm Shelter Openings): Multi-point exit devices specifically engineered for out-swinging door applications on tornado or hurricane resistant storm shelter openings. Extra heavy duty steel component construction with each of the latching points automatically activated when the device is locked. The multi-point exit

device is approved for usage as part of a complete ICC 500 (2014/2020) and FEMA P-361 (2015/2021) door, frame and hardware assembly.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - FE5400S Series.
 - b. Sargent Manufacturing (SA) - FM8700 Series.

2.4 INTEGRATED WIRED OUTPUT EXIT DEVICES - MULTI-CLASS READER

- A. Integrated Wired Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated card reader with or without keypad option, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
 1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
 2. Integrated reader supports the following credentials:
 - a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
 - b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
 - c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
 - d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
 - e. NFC-enabled mobile phones
 - f. PIN code only or PIN + credential with keypad option
 3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
 4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
 6. Manufacturers:
 - a. Sargent Manufacturing (SA) - SN200/SN210 80 Series.

2.5 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Rixson (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.
- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
 - a. Norton Rixson (NO) - Unitrol Series.

2.6 ELECTROMECHANICAL DOOR OPERATORS

- A. Electromechanical Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 and UL10C certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Activation by push button, hands-free or radio frequency devices.
 - c. Adjustable opening force and closing power.
 - d. Two-year limited warranty.
 - e. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
 - f. Mounting backplate to simplify and speed up installation.
 - g. Integration with access control systems.
 2. Operators shall have the following functionality:
 - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
 - c. Emergency Interface Relay: Door closes and ignores any activation input until signal is discontinued.
 - d. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - e. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.
 - f. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
 - g. Open Delay: Delays operator opening for locking hardware.
 - h. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.
 - i. Power Assist: Senses the door is being opened manually and applies small amount of power to assist the user in opening the door with force less than

- 5 lbs. The door opens only as far as it is moved manually, then closes once released.
- j. Power Close: Additional force to assist door closing between 7° and 2°.
- k. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
- l. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
- m. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
- n. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
- o. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.

3. Manufacturers:

- a. Norton Rixson (NO) - 6300 Series.

2.7 ARCHITECTURAL TRIM AND ACCESSORIES

- A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1" less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

- a. Meets ADA requirements for smooth bottom door surfaces.
- b. UL Classified options for use on fire-rated doors up to 3 hours.
- c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
- d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
- e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
- f. Fasteners included; adhesive-backed options available for select models.
- g. Ten-year limited warranty.

2. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood (RO).
- c. Trimco (TC).

2.8 DOOR STOPS AND HOLDERS

- A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.9 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- G. Manufacturers:
 - 1. National Guard Products (NG).

2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.10 ELECTRONIC ACCESSORIES

- A. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.

1. Manufacturers:
 - a. Securitron (SU) - MK Series.

- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:
 - a. Securitron (SU) - DPS Series.

- C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.
 - a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
 - b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
 - c. Enhanced surge immunity for input/output protection
 - d. Separate, dedicated battery charging circuit to keep locks cooler.
 - e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
 - f. Instant auto-switch to battery on AC loss.
 - g. Expandable up to 16 outputs in the standard enclosure
 - h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
 - i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
 - j. Lifetime replacement, no-fault, no questions asked warranty.
2. Manufacturers:
 - a. Securitron (SU) - AQL Series.

2.11 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
- B. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the 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. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- B. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. MR - Markar
 - 3. PE - Pemko
 - 4. SU - Securitron
 - 5. RO - Rockwood
 - 6. SA - SARGENT
 - 7. NO - Norton
 - 8. OT - Other
 - 9. DR - DoorBird

Hardware Sets

Set: 1.0

Doors: 116-1

Description: Ext, Alum, Staff Entry

1 Continuous Hinge	CFM__SLF-HD1 PT		PE
1 Electric Power Transfer	EL-CEPT	630	SU
1 Rim Exit Device	DG164 SN200-PE8876 WEND	US32D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer Stop Arm	CPS7500	689	NO
1 Rain Guard	346C		PE
1 Gasketing	By Door/Frame Manufacturer		OT
1 Sweep	315CN		PE
1 Threshold	171A		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Video Door Intercom Station	DoorBird D31TDV Series	V4A	DR
1 Position Switch	DPS-M-BK		SU
1 Power Supply	AQL (by amprage required)		SU

Notes: Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch.
3. Egress free for immediate exit.
4. Integrated REX switch in push rail allows authorized exit without alarm condition.
5. Integrated door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 2.0

Doors: 101-1

Description: Ext, Alum, Access Control, Public Entry

1 Continuous Hinge	CFM__SLF-HD1 PT		PE
1 Electric Power Transfer	EL-CEPT	630	SU
1 Rim Exit Device, MELR	DG164 55 56 PE8806 WEND	US32D	SA
1 Core	DG164 6300	US15	SA
1 Automatic Opener	6300 Series	689	NO
1 Rain Guard	346C		PE
1 Gasketing	By Door/Frame Manufacturer		OT
1 Sweep	315CN		PE
1 Threshold	171A		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Video Indoor Station	DoorBird A1101	BLK	DR
1 Video Door Intercom Station	DoorBird D31TDV Series	V4A	DR
1 Position Switch	DPS-M-BK		SU
1 Card Reader	By Security		OT
1 Switch Post	500	689	NO
1 Door Switch	502		NO
1 Keyswitch	MKA		SU
1 Power Supply	AQL (by amprage required)		SU

Notes: Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch and initiating operator.
3. Exit device latch can be electrically held retracted for open access.
4. ADA access by actuator switch.
5. In locked condition, actuator energized only upon valid card reader presentation.
6. Egress free for immediate exit. ADA egress by actuator switch.
7. REX switch in push rail allows authorized exit without alarm condition.
8. Door position switch monitor open/closed status.
9. Exit device latch releases (fail secure) in event of power loss.
10. Keyed cylinder override for emergency access.
11. Keyswitch to power operator on/off.

Set: 2.1

Doors: 123

Description: Ext, PR, Mechanical

6 Hinge, Full Mortise, Hvy Wt	T4A3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555	US26D	RO
1 Storeroom Lock	DG164 8204 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
2 Surface Closer Stop Arm	CPS7500	689	NO
2 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Astragal	355CS		PE
1 Gasketing	303AV		PE
1 Rain Guard	346C		PE
2 Sweep	315CN		PE
1 Threshold	171A		PE

Set: 3.0

Doors: 101-2, 116-2

Description: Alum, Access Control, Public/Staff Entry

1 Continuous Hinge	CFM__SLF-HD1 PT		PE
1 Electric Power Transfer	EL-CEPT	630	SU
1 Rim Exit Device	DG164 SN200-PE8876 WEND	US32D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer (Reg/Par)	7500	689	NO
1 Door Stop	442 or 409	US26D	RO
1 Gasketing	By Door/Frame Manufacturer		OT
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Position Switch	DPS-M-BK		SU
1 Power Supply	AQL (by amprage required)		SU

Notes: Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch.
3. Egress free for immediate exit.
4. Integrated REX switch in push rail allows authorized exit without alarm condition.
5. Integrated door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 4.0

Description: SET NOT USED

Set: 5.0

Doors: 111-1

Description: Rated, PR, Access Control, Mech Room

6 Hinge, Full Mortise	TA2714xNRP 4-1/2" x 4-1/2"	US26D	MK
2 Electric Power Transfer	EL-CEPT	630	SU
2 Dust Proof Strike	570	US26D	RO
1 Auto Flush Bolt	2842	US26D	RO
1 Access Control Lock-SN200	DG164 SN200-82271 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
2 Surface Closer Stop Arm	CPS7500	689	NO
2 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Astragal	355CS		PE
1 Gasketing	S88BL		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Power Supply	AQL (by amprage required)		SU

Notes: Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Integrated REX switch allows authorized exit without alarm condition.
5. Integrated door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 6.0

Doors: 110

Description: Rated, Access Control, Equip Racks

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
1 Access Control Lock-SN200	DG164 SN200-82271 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer Stop Arm	CPS7500	689	NO
1 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Gasketing	S88BL		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Power Supply	AQL (by amprage required)		SU

Notes: Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Integrated REX switch allows authorized exit without alarm condition.
5. Integrated door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 7.0

Doors: 107, 113, 120

Description: Storage

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG164 8204 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Door Stop	442 or 409	US26D	RO
3 Silencer	608-RKW		RO

Set: 8.0

Doors: 118

Description: Storage, Bullet Resistant

1 Continuous Hinge	FM3500	630	MR
1 Storeroom Lock	DG164 8204 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer Stop Arm	CPS7500	689	NO
1 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

Set: 9.0

Doors: 102, 103, 104, 105, 106

Description: Office

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	DG164 8205 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Door Stop	442 or 409	US26D	RO
1 Gasketing	S88BL		PE

Set: 10.0

Doors: 112

Description: Conference

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	DG164 8205 LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer (Reg/Par)	7500	689	NO
1 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Door Stop	442 or 409	US26D	RO
1 Gasketing	S88BL		PE

Set: 11.0

Description: SET NOT USED

Set: 12.0

Doors: 119, 122

Description: Mothers Room/Quiet Room

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	V21 8265 LNND	US26D	SA
1 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW CSK BEV	US32D	RO
1 Door Stop	442 or 409	US26D	RO
1 Gasketing	S88BL		PE

Set: 13.0

Doors: 114, 115

Description: Restroom

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	V21 8265 LNND	US26D	SA
1 Surface Closer (Reg/Par)	7500	689	NO
1 Kick Plate	K1050 12" x 2" LDW CSK BEV	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW CSK BEV	US32D	RO
1 Door Stop	442 or 409	US26D	RO
1 Gasketing	S88BL		PE

Set: 14.0

Doors: [108-3](#)

Description: Ext, Rated, Communications Workstations, FEMA ICC 500 Shelter

4 Hinge, Hvy Wt	SP3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1 Surface Vert Rod Exit, Exit Only	12 FMPE8710 EO	US32D	SA
1 Surface Closer	UNI7500 TBGN	689	NO
1 Latch Cover Kick Plate	BFLG1050 10" 2" LDW	US32D	RO
1 Door Stop	462	US2C	RO
1 Rain Guard	346C		PE
1 Gasketing	S88BL		PE
1 Sweep	345ANB x Door Width		PE
1 Threshold	1715A x Opening Width		PE
1 Position Switch	DPS-M-BK		SU

Notes: Cutout threshold so bottom strike can be mounted to concrete floor and not on the threshold.

Door will have a 5/8" undercut.

Set: 15.0

Doors: 111-2

Description: Ext Rated, PR, Access Control, FEMA ICC 500 Shelter

8 Hinge, Hvy Wt	SP3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
2 Surface Bolt	988	Bright Zinc	SA
1 Access Control Multi-Point	SN200-FM73281-24V LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Coordinator	576	US26D	RO
2 Surface Closer	UNI7500 TBGN	689	NO
2 Kick Plate	K1050 WS 10" x 2" LDW CSK BEV	US32D	RO
1 Rain Guard	346C		PE
1 Gasketing	S88BL		PE
2 Sweep	345ANB x Door Width		PE
1 Threshold	1715A x Opening Width		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Power Supply	AQL (by amprage required)		SU

Notes: Metal overlapping astragal furnished by Hollow Metal Door Supplier.

Surface bolts must be installed on the shelter side of the door so surface bolts are protected.

Doors will have a 3/8" undercut.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Integrated REX switch allows authorized exit without alarm condition.
5. Integrated Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 16.0

Doors: 109

Description: Rated, Access Control, FEMA ICC 500 Shelter

4 Hinge, Hvy Wt	SP3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
1 Access Control Multi-Point	SN200-FM73281-24V LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer	UNI7500 TBGN	689	NO
1 Kick Plate	K1050 WS 10" x 2" LDW CSK BEV	US32D	RO
1 Wall Stop	406	US32D	RO
1 Gasketing	S88BL		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Power Supply	AQL (by amprage required)		SU

Notes: Door will have a 3/8" undercut.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Integrated REX switch allows authorized exit without alarm condition.
5. Integrated Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 17.0

Doors: 108-1, 108-2

Description: Rated, Access Control, FEMA ICC 500 Shelter

4 Hinge, Hvy Wt	SP3386xNRP 4-1/2" x 4-1/2"	US32D	MK
1 Electric Power Transfer	EL-CEPT	630	SU
1 Access Control Multi-Point	SN200-FM73281-24V LNND	US26D	SA
1 Core	DG164 6300	US15	SA
1 Surface Closer	UNI7500 TBGN	689	NO
1 Kick Plate	K1050 WS 10" x 2" LDW CSK BEV	US32D	RO
1 Gasketing	S88BL		PE
1 ElectroLynx Harness	QC-C1500		MK
1 ElectroLynx Harness	QC-CXXXP		MK
1 Power Supply	AQL (by amprage required)		SU

Notes: Door will have a 3/8" undercut.

Operational Narrative:

1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim.
3. Egress free for immediate exit.
4. Integrated REX switch allows authorized exit without alarm condition.
5. Integrated Door position switch monitors open/closed status.
6. Lever remains locked (fail secure) in event of power loss.
7. Keyed cylinder override for emergency access.

Set: 18.0

Description: Maintenance Manual

1 Furnish	Maintenance Manual	SA
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Notes: Maintenance manual will be given to the owner.

END OF SECTION 087100

SECTION 088000 – GLAZING

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.
- B. Related Work
 - 1. Section 051200 - Structural Steel Framing
 - 2. Section 054000 - Cold-Formed Metal Framing
 - 3. Section 072100 – Thermal Insulation
 - 4. Section 076200 – Sheet Metal Flashing and Trim
 - 5. Section 079200 - Joint Sealants
 - 6. Section 088000 - Glazing
 - 7. Section 084113 - Aluminum-Framed Entrances and Storefronts
 - 8. Section 084413 - Glazed Aluminum Curtain Walls
 - 9. Section 084414 - Security Glazed Aluminum Curtain Walls
 - 10. Section 092900 - Gypsum Sheathing
 - 11. Section 092940 - Gypsum Trim and Accessories

1.2 SUMMARY

- A. This 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. Windows.
 - 2. Doors.
 - 3. Storefront framing.
 - 4. Glazed entrances.
 - 5. Curtain walls.
 - 6. Interior borrowed lites.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 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. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For the following products, in the form of 12-inch- square Samples for glass.
 - 1. Insulating glass for each designation indicated.
 - 2. Fire rated glass.
 - 3. Laminated glass.
- C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch lengths. Fire rated sealants.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of insulating-glass units.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass and glazing sealants.
 - 1. For glazing sealants, including fire rated glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Special warranties specified in this Section.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Refer Division 08 Sections "Aluminum Framed Entrances and Storefronts" and "Glazed Aluminum Curtain Walls".
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. 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.
- C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Guardian Industries glazing units, or comparable product by one of the following:
 - 1. Viracon.
 - 2. JE Berkowitz.
 - 3. PPG Industries.
- B. Basis-of-Design Products for Fire Resistive Glass: Subject to compliance with requirements, provide SAFTI FIRST glazing units, or comparable product by one of the following:
 - 1. Technical Glass Products.
 - 2. Vetrotech Saint-Gobain North America, Inc.
- C. Basis-of-Design Products for One-Way Mirror Glass: Subject to compliance with requirements, provide Pilkington glazing units.
- D. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 - 1. Obtain tinted glass from single source from single manufacturer.
 - 2. Obtain reflective-coated glass from single source from single manufacturer.
- E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. 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. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. 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 (W/sq. m x K).
 5. 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.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: "Laminated Glazing Reference Manual" and "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 is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. 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

- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

- 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

- E. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.4 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.

- 1. For uncoated glass, comply with requirements for Condition A.
 - 2. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

- 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated

- D. Fire Resistive Gel Filled Safety Glass: Transparent fire-resistive safety glazing fabricated from two lites of tempered glass as specified, gel filled and sealed.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

- a. SAFTI; Superlite II.-XL.

- 2. Thickness: Manufacturer's standard for applications indicated.
 - 3. Fire Rating: 60 and 120 minute rating as listed in UL Building Materials Directory and approved by authority having jurisdiction for applications indicated.
 - 4. Safety Glazing: Comply with CPSC 16 CFR 1201 Category II.

- E. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

- 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.

3. Interlayer Color: Clear unless otherwise indicated

2.5 INSULATING-GLASS UNITS

- A. 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, with manufacturer's standard primary and secondary.
 2. Spacer Specifications: Manufacturer's standard spacer material and construction.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.6 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 100/50, Use NT.
 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 Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. May National Associates, Inc.; Bondaflex Sil 290.
 - d. Pecora Corporation; 890.
 - e. Sika Corporation, Construction Products Division; SikaSil-C990.
 - f. Tremco Incorporated; Spectrem 1.
- C. Fire-Resistant Glazing Materials: Materials used to obtain required fire-resistant rating, as approved by glass manufacturer.

2.7 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 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. 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.

2.9 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned 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.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 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 as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 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. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 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.

3.6 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.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC-GLASS TYPES - SCHEDULE

- A. Clear fully non-tempered float glass.
 - 1. Thickness: 1/4 inch.
- B. Clear fully tempered float glass.
 - 1. Thickness: 1/4 inch.
 - 2. Provide safety glazing labeling.
- C. Ceramic-coated spandrel glass, heat-strengthened float glass – Guardian Industries.
 - 1. Thickness: 1/4 inch.
 - 2. Ceramic Coating Color: Frit on #3 surface and spandrel on #4 surface. Frit pattern and color as selected.
 - 3. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
- D. One-Way Mirror Glass:
 - 1. Thickness: 1/4 inch.
 - 2. Install mirror coating toward subject-side.
- E. Laminated Glass:
 - 1. Thickness: Minimum 1 inch.
- F. Fire Resistive Gel Filled Safety Glass:
 - 1. Thickness as required to meet 60 and 120 minute fire rating.
 - 2. Fire rated glazing materials.

3.9 INSULATING-GLASS TYPES - SCHEDULE

A. Glass Type 1 (G1): Guardian Industries SN 68:

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 1/4 inch.
3. Outdoor Lite: Guardian SunGuard, SuperNeutral 68 on Clear.
4. Interspace Content: 1/2 inch air space.
5. Indoor Lite: Clear Heat Strengthened glass.
6. Winter Nighttime U-Factor: 0.29 percent maximum.
7. Summer Daytime U-Factor: 0.28 maximum.
8. Visible Light Transmittance: 68 percent minimum.
9. Solar Heat Gain Coefficient: 0.38 maximum.

B. Glass Type 2 (G2): Guardian Industries SN 68

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 1/4 inch.
3. Outdoor Lite: Guardian SunGuard, SuperNeutral 68 on Clear.
4. Interspace Content: 1/2 inch air space.
5. Indoor Lite: Clear Heat Strengthened glass.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.28 maximum.
8. Visible Light Transmittance: 68 percent minimum.
9. Solar Heat Gain Coefficient: 0.38 maximum.
10. See Specification Section 088853 - Security Glazing, Aluminum Framing And Doors

END OF SECTION 088000

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SECTION 088010 - SECURITY GLAZING

PART 1 -GENERAL

1.1 SUMMARY

A. Security glazing required for the following:

1. Interior Security Hollow Metal Frames- Door 100-1
2. Interior Security Hollow Metal Frames – Impact Resistant
3. Exterior Security Aluminum Curtain Walls – Impact Resistant

B. Related Work

1. Section 051200 - Structural Steel Framing
2. Section 054000 - Cold-Formed Metal Framing
3. Section 072100 – Thermal Insulation
4. Section 076200 – Sheet Metal Flashing and Trim
5. Section 079200 - Joint Sealants
6. Section 088000 - Glazing
7. Section 084414 - Security Glazed Aluminum Curtain
8. Section 084415 - Metal Window Panels
9. Section 092900 - Gypsum Sheathing
10. Section 092940 - Gypsum Trim and Accessories

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor to design security glazing for wind and snow loads.

B. Windborne-Debris-Impact Resistance: Provide exterior security glazing that passes FEMA 361 testing requirements.

1.3 WARRANTY

A. Laminated Glass and Polycarbonate: Ten years.

B. Insulating Security Glazing with laminated glass and polycarbonate: Ten years.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Windborne-Debris-Impact Resistance: Windborne-Debris-Impact Resistance: Provide exterior security glazing that passes FEMA 361 testing requirements.

B. Security Glazing Type SG-1: Clear symmetrical glass-clad for interior locations.

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. Protective Armored Systems Inc.
 - b. LTI Smart Glass, Inc.
 - c. Global Security
2. Ballistic Resistance: Level 4 per UL 752.
3. Overall Unit Thickness: 1 ¼ inches>.
4. Outer Ply: heat-strengthened, chemically strengthened, or float glass.
5. Multiple Core:
 - a. Outer Core Ply: polycarbonate.
 - b. Inner Core Ply polycarbonate.
6. Inner Ply: heat-strengthened, chemically strengthened or float glass.

2.2 INSULATING SECURITY GLAZING TYPES

A. Security Glazing Type SG-2: Low-e-coated, clear insulating security glazing. Outdoor lite is monolithic glass and indoor lite is glass-clad polycarbonate, For exterior locations

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. Protective Armored Systems Inc.
 - b. LTI Smart Glass, Inc.
 - c. Global Security
2. Ballistic Resistance: Level 4 per UL 752.
3. Storm Resistance: FEMA 361
4. Overall Unit Thickness: 2 inches.
5. Outdoor Lite: Basis of design PPG Solarban 60 Clear or equal
6. Outdoor Lite Thickness 1/4" inch.
7. Indoor Lite: Glass-clad polycarbonate.
8. Interspace Content: Argon.
9. Interspace Dimension: ¼ inch.
10. Low-E Coating: Sputtered on second surface.
11. Overall Visible Light Transmittance: 0.81 percent minimum.
12. Winter Nighttime U-Factor: 0.57 maximum.
13. Solar Heat-Gain Coefficient: 0.39 maximum.

B. Security Glazing Type SG-3: Spandrel insulated security panel. For exterior locations:

1. Windborne-Debris Impact Resistance: Pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for protection.
2. Large-Missile Test: For glazing located within 30 ft. of grade.
 - a. Insulated Spandrel Panels:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Survivalite or approved equal. **Refer to Section 084415- Metal Window Panels.**

2.3 INSTALLATION

A. Glazing Method: Tape glazing.

PART 3 – EXECUTION

3.1 EXAMINATION

- B. Examine framing for security glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Minimum required bite.
 - 5. Effective sealing between joints of framing members.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

1.2 PREPARATION

- A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

1.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

- F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
- H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

1.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by security glazing, 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. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing 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.

- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

1.5 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 securely in place between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

1.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. 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 security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

1.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. 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.

1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 088010

SECTION 088300 - MIRRORS

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 types of silvered flat glass mirrors.
 - 1. Tempered glass mirrors qualifying as safety glazing.
- B. Related Sections include the following:
 - 1. Section 088000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.3 DEFINITIONS

- A. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide mirrors that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass

coating components, edge sealer, and quality-control provisions.

2. Mirror mastic.
 3. Mirror hardware.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- C. Samples: For each type of mirror product required, in the form indicated below:
1. Mirrors, 12 inches square, including edge treatment on 2 adjoining edges.
 2. Mirror clips.
 3. Mirror trim, 12 inches long.
- D. Product Certificates: For each type of mirror and mirror mastic, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Mirror Mastic Compatibility Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing paint and substrates on which mirrors are installed.
- G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed mirror glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirror installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under NGA's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. Source Limitations for Mirrors: Obtain mirrors from one source for each type of mirror indicated.
- C. Source Limitations for Mirror Glazing Accessories: Obtain mirror glazing accessories from one source for each type of accessory indicated.
- D. Glazing Publications: Comply with the following published recommendations:
1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- E. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
- F. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint and substrates on which mirrors are installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mirrors that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide mirrors by one of the following:

1. Arch Aluminum & Glass Co., Inc.
2. Gardner Glass Products.
3. Gilded Mirrors, Inc.
4. Guardian Industries Corp.
5. Independent Mirror Industries, Inc.
6. Lenoir Mirror Company.
7. Messer Industries, Inc.
8. Stroupe Mirror Co., Inc.
9. Sunshine Mirror.
10. Virginia Mirror Company, Inc.
11. VVP America, Inc.; Binswanger Mirror Products.
12. Walker Glass Co., Ltd.

2.2 SILVERED FLAT GLASS MIRROR MATERIALS

- A. Tempered Clear Glass Mirrors: Comply with ASTM C 1503, Mirror Glazing Quality, for blemish requirements in annealed float glass before silver coating is applied, for coating requirements, and with other requirements not affected by tempering process; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: 3.0 mm.
2. Size: Refer to DWG A819.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
1. 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:
 - a. Gunther Mirror Mastics.
 - b. Palmer Products Corporation.

2.4 MIRROR HARDWARE

1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
2. Product: Subject to compliance with requirements, provide the following:
 - a. Bottom Trim: C. R. Laurence Co., Inc.; D638 FHA Type "J" Channel.
- B. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
 1. Profile: As indicated.
 2. Finish: As selected from manufactures standard finishes by Architect
- C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

- A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes. Refer to DWG A819 for mirror size and layout.
- B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished edge.
 1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with mirror installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. For wall-mounted mirrors, install mirrors with mastic and mirror hardware.
 1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 2. For mirror hardware in the form of continuous J-channels at bottom, provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long.
 3. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 088300

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SECTION 088853 - SECURITY GLAZING, ALUMINUM FRAMING AND DOORS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract," "Special Conditions," and "Division 1 – General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. Work of this Section includes complying with the requirements of Specification Section 01 8113 – Sustainable Design Requirements.
- B. Work of this Section includes complying with the requirements of Specification Section 01 8114 – Low Emitting Materials.

1.3 RELATED DOCUMENTS

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

1.4 SUMMARY

- A. Section includes the following:
 - 1. Glass-clad polycarbonate glazing
 - 2. Bullet-resistant aluminum framing and doors.

1.5 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 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. Review temporary protection requirements for security glazing during and after installation.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Security Glazing Samples: For each type of security glazing; 12 inches square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
- E. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of insulating security glazing with sputter-coated, low-e coatings.
- B. Product Certificates: For each type of product indicated, from manufacturer.
- C. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
 - 1. Provide test reports based on testing current sealant formulations within previous 36-month period.
- E. Preconstruction adhesion and compatibility test reports.
- F. Sample Warranties: For special warranties.

1.9 QUALITY ASSURANCE

- A. Retain option in "Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings" Paragraph below only if products listed in Part 2 for sputter-coated, low-e-coated, insulating glazing units are those of manufacturers with a certified fabricator program.
- B. Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings: A qualified insulating glazing manufacturer who is approved and certified by coated-glass manufacturer.

- C. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
- D. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
 - 1. H. P. White Laboratory, Inc.
 - 2. Underwriters Laboratories, Inc.
 - 3. Wiss, Janney, Elstner Associates, Inc.
- E. Sealant Testing Agency Qualifications: Qualified according to ASTM C 1021 for testing indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated Glass: Manufacturer agrees to replace coated glass that deteriorates within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated glass that deteriorates within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed

to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

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

- C. Manufacturer's Special Warranty for Polycarbonate Sheet: Manufacturer agrees to replace polycarbonate sheet that deteriorates within specified warranty period. Deterioration of polycarbonate sheet is defined as defects developed from normal use that are not attributed to maintaining and cleaning polycarbonate sheet contrary to manufacturer's written instructions. Defects include yellowing and loss of light transmission.

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

- D. Manufacturer's Special Warranty for Laminated Polycarbonate: Manufacturer agrees to replace laminated polycarbonate that deteriorates within specified warranty period. Deterioration of laminated polycarbonate is defined as defects developed from normal use that are not attributed to maintaining and cleaning laminated polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.

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

- E. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration of glass-clad polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.

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

- F. Manufacturer's Special Warranty for Laminated Glass and Polycarbonate: Manufacturer agrees to replace laminated glass and polycarbonate that deteriorates within specified warranty period. Deterioration of laminated glass and polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass and polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.

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

- G. Manufacturer's Special Warranty on Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that deteriorates within specified warranty period. Deterioration of insulating security glazing is defined as defects in individual lites developed from normal use or failure of hermetic seal under normal use. Deterioration does not include defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions.
1. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
 2. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 3. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 4. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.
 5. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.
- B. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General:
1. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.
 2. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.
- B. Delegated Design: Engage a qualified professional engineer to design security glazing.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

- A. Glazing Publications: Comply with published recommendations of security glazing and glazing material 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: "Glazing Manual."
 2. AAMA Publications: AAMA GD5G-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
- C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.
- D. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.
- E. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
1. Self-ignition temperature of 650 deg F (343 deg C) or more when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
 2. Smoke-Developed Index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
 3. Burning extent of 1 inch (25 mm) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work.

- F. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and 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 (W/sq. m x K).
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.

G. GLASS-CLAD POLYCARBONATE

1. Manufacturer: As basis of design – Total Security Solutions, Inc.
 - a. Acceptable manufacturers include: Global Security Glazing
2. Product (Interior Glazing): Bullet Resistant Glass-Clad Polycarbonate Security Glazing.
 - a. Performance:
 - 1) UL listed Level 5.
 - 2) TSS 005 L/S – 1 5/8".
 - 3) TSS 5-500 – 1 13/16".

2.4 FRAMING SYSTEM

- A. Manufacturer: As basis of design - Insulgard Security Products.
- B. Product: TSS Bullet Resistant Stainless Steel Frame.
1. TSS Bullet Resistant Stainless Steel Frame shall be of the "non-ricochet" type. Frames shall be fabricated of 18 gauge steel with a #4 stainless steel finish. Glazing must not be removable from the threat side of the sash.
 2. Dimensions:
 - a. Profile: 3 inches by 4 7/8 inches.
 3. Ballistic Resistant: Level 5 in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.
 4. Finish: #4 stainless steel.
- C. Reference Section 08 3400 Bullet Resistant Doors and Frames for information regarding bullet resistant doors and bullet resistant hollow metal frames.

2.5 ACCESSORIES

- A. Anchors: Fully concealed.
- B. Internal framing fasteners: Stainless steel Type 18-8.

- C. Framing to structure: Based on substrate.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, 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 security glazing 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 Professional from manufacturer's full range.

- B. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C 920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C 661.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. BASF Corporation; Construction Systems.

2.7 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 security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. 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.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
- F. 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.

2.9 FABRICATION OF SECURITY GLAZING

- A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed security glazing edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing for security glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Minimum required bite.
 - 5. Effective sealing between joints of framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
- F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
- H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

- I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by security glazing, 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. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 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 securely in place between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. 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 security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. 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.
 - 1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 088853

SECTION 089100 – ALUMINUM LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install louvers, bird screens, blank-off panels, structural supports and attachment brackets as shown on the drawings, as specified, and as needed for a complete and proper installation.
- B. The louvers to be furnished include the following:
 - 1. Drainable fixed extruded louvers.
- C. Related sections include:
 - 1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.
 - 1. AMCA Standard 500-L Laboratory Methods of Testing Louvers for Rating.
 - 2. AMCA Publication 501 Application Manual for Louvers.
- B. The Aluminum Association Incorporated.
 - 1. Aluminum Standards and Data.
 - 2. Specifications and Guidelines for Aluminum Structures.
- C. American Society of Civil Engineers.
 - 1. Minimum Design Loads for Buildings and Other Structures.
- D. American Society for Testing and Materials
 - 1. ASTM B209.
 - 2. ASTM B211.
 - 3. ASTM B221.
 - 4. ASTM E90-90.
- E. Architectural Aluminum Manufacturers Association.
 - 1. AAMA 800 Voluntary Specifications and Test Methods for Sealants.
 - 2. AAMA 605.2 Voluntary Specification for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA TIR Metal Curtain Wall Fasteners.
 - 4. AAMA 2605-98 Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.3 SUBMITTALS

A. Product Data.

1. Air flow and water entrainment performance test results.
2. Material types and thickness.

B. Shop Drawings.

1. Include elevations, sections and specific details for each louver.
2. Show anchorage details and connections for all component parts.
3. Include signed and sealed structural calculations.

C. Samples.

D. Submit color chips for approval.

1.4 QUALITY ASSURANCE

- A. Single subcontract responsibility: Subcontract the work to a single firm that has had not less than six years experience in the design and manufacturing of work similar to that shown and required.
- B. Performance Requirements: Provide AMCA and BSRIA test data as required to confirm that the louvers have the specified air and water performance characteristics.
- C. Acoustical Performance: Where applicable, submit test reports to confirm that the louvers meet the specified STC and Noise Reduction requirements.
- D. Structural Requirements: Design all materials to withstand wind and snow loads as required by the applicable building code. Maximum allowable deflection for the louver structural members to be $l/180$ or 0.75 inch, whichever is less. Maximum allowable deflection for the louver blades to be $l/120$ or 0.50 inch across the weak axis, whichever is less.
- E. Professional Engineer Requirements: Drawings and structural calculations to be signed and sealed by a professional engineer licensed to practice in the project state.
- F. Warranty: Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery: At the time of delivery all materials shall be visually inspected for damage. Any damaged boxes, crates, louver sections, etc. shall be noted on the receiving ticket and immediately reported to the shipping company and the material manufacturer.

B. Storage:

1. Material may be stored flat, on end or on its side.
2. Material may be stored either indoors or outdoors.
3. If stored outdoors the material must be raised sufficiently off the ground to prevent it being flooded.
4. If stored out doors the material must be covered with a weather proof flame resistant sheeting or tarpaulin.

C. Handling:

1. Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.
2. Louver sections may be hoisted by attaching straps to the jambs and lifting the section while it is in a vertical position.
3. Louver sections should only be lifted and carried by the jambs. Heads, sills and blades are not to be used for lifting or hoisting louver sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide RS-7705 by Construction Specialties, Inc., other available manufacturers offering acceptable equivalent products that may be incorporated into the Work include, but are not limited to, the following:

1. Airolite.
2. Ruskin.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B211, Alloy 6063-T5, 6063-T6 or 6061-T6.
- B. Aluminum Sheet: ASTM B3209, Alloy 1100, 3003 or 5005.

2.3 FABRICATION, GENERAL

- A. Provide CS louver models, bird screens, blank-off panels, structural supports and accessories as specified and/or shown on the drawings. Materials, sizes, depths, arrangements and material thickness to be as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.
- B. Louvers to be mechanically assembled using stainless steel or aluminum fasteners.
- C. Include supports, anchorage, and accessories required for complete assembly.

2.4 LOUVER MODELS

- A. CS Model RS-7705 Continuous Blade.

1. Size: 7 3/8" deep drainable louver.
2. Color: Mica Metallic.
3. Accessories:
 - a. Bird Screen.
 - b. Insulated blank-off panels where there is no ductwork.

2.5 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by architect.
- B. Two Coat Fluorocarbon Coating
 1. Louvers to be finished with a minimum 1.0 mil (0.025mm) thick full strength 70% resin, 2 coat Fluoropolymer system.
 2. All aluminum shall be thoroughly cleaned, etched and given a chromated conversion pre-treatment before application of the MICA II coating. The coating shall consist of a primer and a pearlescent pigmented PFV2 topcoat. It shall receive a bake cycle of 17 minutes at 450°F. All finishing procedures shall be one continuous operation in the plant of the manufacturer.
 3. Manufacturer to furnish an extended 20 limited warranty for the Kynar/Hylar coating. This limited warranty shall begin on the date of material shipment.

2.6 BIRD SCREENS

- A. Unless otherwise indicated, all louvers to be furnished with mill finish bird or insect screens.
- B. Screens to be 18 x 16 aluminum mesh 0.011" (0.279mm) diameter wire insect screens secured within 0.055" (1.40mm) thick extruded aluminum frames. Frames to have mitered corners and corner locks.

2.7 BLANK OFFS

- A. Furnish where indicated on the drawings blank-off panels fabricated by the louver manufacturer.
- B. Blank-off panels to be 2" (50.8mm) thick and to be faced on both sides with 0.032" (0.81 mm) thick aluminum sheet. Panels to be fabricated with an expanded polystyrene (EPS) core having an R-value of 8 ($^{\circ}\text{F}\cdot\text{ft}^2\cdot\text{h}/\text{Btu}$). Panel perimeter frame to be 0.050" (1.27mm) thick-formed aluminum channels. Panel frame to be mitered at the corners. Panels to be finished to match louvers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings to receive the work. Do not proceed until any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of the work.
- B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.
- C. Anchor louvers to the building substructure as indicated on architectural drawings.
- D. Erection Tolerances:
 - 1. Maximum variation from plane or location shown on the approved shop drawings: 1/8" per 12 feet of length, but not exceeding 1/2" in any total building length or portion thereof (non-cumulative).
 - 2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3": 1/16" (shop or field joints). This limiting condition shall prevail under both load and no load conditions.
- E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.
- F. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- G. Set units level, plumb and true to line, with uniform joints.

3.3 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 ADJUSTING AND CLEANING

- A. Immediately clean exposed surfaces of the louvers to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.

- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Architect, remove damaged materials and replace with new materials.
 - 1. Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

END OF SECTION 089100

SECTION 092216 - NON-STRUCTURAL 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. This Section includes the following:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
- B. Related Sections include the following:
 - 1. Division 5 "Cold-Formed Metal Framing" for exterior and interior load-bearing and non-load bearing assemblies.
 - 2. Division 9 "Gypsum Board" for interior gypsum board and tile backing board panels and related fastening accessories.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, and firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. STC-Rated Assemblies: For STC-rated assemblies, 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.

2.2 NON-LOAD BEARING STEEL FRAMING SYSTEMS

- 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: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: Per UL Design Standards, or indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 - 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: Per UL Design Standards, or indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-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 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.

- 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
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. Fire Trak Corp.; Fire Trak System.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: Per UL Design Standards, or indicated on Drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: Per UL Design Standards, or indicated on Drawings.
 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. 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 thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 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.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. 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 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. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. 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 o.c.
- F. Z-Furring Members:
 - 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. 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. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

- 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. 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.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

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 gypsum board.
 - 2. Tile backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: 12-inch long samples of each trim accessory indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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 blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.
- B. STC-Rated Assemblies: For STC-rated assemblies, 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.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Basis of Design Product: Subject to compliance with requirements, provide products as manufactured by USG Corporation, or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Georgia-Pacific Gypsum LLC.
 - 3. Lafarge/Continental Building products.
 - 4. National Gypsum Company.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: As indicated
 - 2. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: As indicated
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
- E. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 3 – Impact Resistant.
 - 1. Core: Fiberglass mesh, 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

- F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.

1. Basis of Design Product: Subject to compliance with requirements, provide USG Corporation; Firecode C Core, or comparable product by one of the following:
 - a. CertainTeed Corp.; ProRoc Type C.
 - b. Georgia-Pacific Gypsum LLC; Fireguard C.
 - c. Lafarge/Continental Building Products; Firecheck Type C.
 - d. National Gypsum Company; Gold Bond Fire-Shield C.
2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Basis of Design Product: Subject to compliance with requirements, provide USG Corporation; DUROCK Cement Board, or comparable product by one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. CertainTeed Corp.; FiberCement BackerBoard.
 - c. Custom Building Products; Wonderboard.
 - d. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - e. James Hardie Building Products, Inc.; Hardiebacker.
 - f. National Gypsum Company, Permabase Cement Board.
2. Thickness: As indicated on Drawings.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc.
2. Shapes:

- a. Cornerbead.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions 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. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- 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 drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. 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 thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. 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.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

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 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, unless otherwise indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

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 and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Not Used.
 - 3. Level 3: Not Used.
 - 4. Level 4: Typical at panel surfaces that will be exposed to view, unless otherwise indicated.
 - 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 09 Painting Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

- F. Maximum variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. 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 092900

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SECTION 092940 - GYPSUM TRIM AND ACCESSORIES

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, as do the following:
 - 1. Section 079500 – Expansion Control
 - 2. Section 061053 – Miscellaneous Rough Carpentry
 - 3. Section 102600 – Wall and Door Protection

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl trims for gypsum board, including accessories and joint treatment.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - 2. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board
 - 3. ASTM C 1002 - Standard Specification for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - 4. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard
 - 5. ASTM C 1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
 - 6. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPCV) Compounds
 - 7. ASTM D 3678 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions
- B. Gypsum Association (GA):
 - 1. GA-214 – Recommended Levels of Gypsum Board Finish
 - 2. GA-216 – Application and Finishing of Gypsum Panel Products
 - 3. GA-600 – Fire Resistance Design Manual

1.4 SUBMITTALS

- A. Submit under provisions of Division 01 - Administrative Requirements.
- B. Product Data: Submit data on vinyl trim and accessories.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Cleaning methods.
- C. Selection Samples: Two sets of full size samples, 9 inches in length, representing manufacturer's full range of available trim products and accessories.
- D. Verification Samples: For each product and accessory specified, two samples, 9 inches in length, representing actual trim products and accessories specified.

1.5 QUALITY ASSURANCE

- A. Mock-Up: Provide a completely assembled, typical wall area installed with related accessories, in composite configurations designed to fulfill the performance criteria, and representative of the design as shown on the Drawings.
 - 1. Locate mock-up in location as directed by the Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by the Architect.
 - 3. Mock-up area may become part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
 - 1. Store in covered area away from direct sunlight.
 - 2. Stack boxes containing trim members flat to prevent sagging.
- B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.7 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 recommended limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Trim-Tex Inc, or equal products provided by one of the following manufacturers:
 - 1. Clark Deitrich
 - 2. Phillips

2.2 TRIM MEMBERS

- A. Basis of Design: Vinyl trim for gypsum board as manufactured by Trim-Tex Inc.; including accessories, joint treatment for trim.
- B. Performance Requirements:
 - 1. Self-Extinguishing: Shall not continue to support combustion once flame source is removed.
 - 2. Meet or exceed following ASTM Standards:
 - a. ASTM E84-10 – Achieve Class A rating for Smoke and Flame Spread
 - b. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard
 - c. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPCV) Compounds
 - d. ASTM D 3678 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions
 - e. GA-216-10 – Gypsum Association
 - f. Impervious to rust, galvanic corrosion, electrolysis and resistant to most chemicals

2.3 COMMERCIAL BEADS

- A. Tear Away Beads
 - 1. Tear Away L Bead. Available in Flat, Extra Tall Masking, and Arch.
 - 2. Tear Away Expansion Joint; 'V' Shape

2.4 METAL REVEALS

- A. Reveal / Channel

1. Basis of Design: Aluminum trim for gypsum board as manufactured by Fry Reglet; including accessories, joint treatment for trim.
2. Reveal Trim: Reveal, DRM-625-75, Aluminum.
3. Corner Trim: 'X' Corner Molding, XDM-625-625, Aluminum, for all outside corners in gypsum walls at corridors and office locations.

2.5 ACCESSORIES

- A. 847 Spray Adhesive or manufacturer's equivalent.
- B. ½" Divergent Staples or manufacturer's equivalent.
- C. Mud Max. Drywall compound adhesion additive or manufacturer's equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Verify site conditions are ready to receive work.
- B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

- A. Install vinyl trim members in accordance with manufacture's written installation instructions.
 1. Compliance: Perform Work in accordance with ASTM C 754.
 2. Compliance: Perform Work in accordance with ASTM C 840.
 3. Compliance: Perform Work in accordance with GA-214.
 4. Compliance: Perform Work in accordance with GA-216.
 5. Compliance: Perform Work in accordance with GA-600.
 6. Compliance: As scheduled and indicated on drawings.
 7. When manufacturer's installation instructions do not specifically cover applicable installation; comply with ASTM C 754, GA-216 and GA-600.
- B. Secure trim members to substrate with staples and spray adhesive in accordance with trim manufacturer's written instructions.

1. Install factory fabricated accessories at joints in trim members with durable:
 - a. Straight edges.
 - b. Straight corners.
2. Apply specified mud to flanges of trim members.
- C. Control Joints: Place control joints consistent with lines of building spaces as indicated on Drawings.
- D. Interior Trim: Install in the following locations:
 1. Aluminum corner trim: outside corners in corridors and office areas.
 2. Corner Bead: Use at outside corners; type as indicated on drawings.
 3. Deflection Bead: Use at head of wall or as indicated on drawings.
 4. L Bead. Use at exposed panel edges, where gypsum abuts different finish material or as indicated on drawings.
 5. Other trims. Use as indicated on drawings.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 092940

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SECTION 093100 – CERAMIC TILE

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:

- 1. Ceramic tile for floors, walls and base.
- 2. Stone thresholds and termination strips.
- 3. Movement joints, sealant and back-up material.
- 4. Shower pan liner.

- B. Related Sections

- 1. Division 3 Section "Cast-In-Place Concrete" work for placement and finish troweling of concrete floor slabs for tile application.
- 2. Division 4 Section "Unit Masonry Assemblies" for concrete block substrate surfaces.
- 3. Division 7 Section "Joint Sealants".
- 4. Division 22 "Plumbing Fixtures."

1.3 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI):

- 1. ANSI A108.1 - Installation of Ceramic Tile with Portland Cement Mortar.
- 2. ANSI A108.4 - Ceramic Tile Installed with Water-Resistant Organic Adhesives.
- 3. ANSI A108.5 - Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- 4. ANSI A108.10 - Installation of Grout in Tilework.
- 5. ANSI A118.1 - Dry-Set Portland Cement Mortar.
- 6. ANSI A118.4 - Latex-Portland Cement Mortar.
- 7. ANSI A118.6 - Ceramic Tile Grouts.
- 8. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
- 9. ANSI A137.1 - Recommended Standard Specifications for Ceramic Tile.

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

- 1. ASTM C144 - Aggregate for Masonry Mortar.
- 2. ASTM C150 - Portland Cement.
- 3. ASTM C206 - Finishing Hydrated Lime.

4. ASTM C207 - Hydrated Lime for Masonry Purposes.
5. ASTM C241 - Abrasion Resistance of Stone Subjected to Foot Traffic.
6. ASTM C503 - Marble Building Stone (Exterior).

C. Tile Council of America (TCA):

1. TCA - Handbook for Ceramic Tile Installation.

D. Marble Institute of America (MIA):

1. MIA - Marble design Manual.

E. Federal Specifications (FS):

1. FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.

1.4 SUBMITTALS

A. Product Data, Samples, and Certificates: Submit in accordance with Division 1.

B. Product Data:

1. Installation Instructions: Submit manufacturer's descriptive literature for mortars, grouts, and adhesives, and recommended installation instructions.
2. Submit manufacturer's certification that materials are suitable for the intended use.
3. Maintenance Literature: Submit manufacturer's maintenance guides for Owners use in accordance with Division 1 Section.

C. Samples:

1. Floor Tile and Wall Tile:

- a. Panel for each color and type (2 each).
- b. Minimum panel size: 8-inch x 8-inch.

2. Thresholds/Termination Strips:

- a. One 6-inch long piece.
- b. Show type, shape, material, and finish.

D. Certificates:

1. Master Grade Certificate: Furnish certificate issued and signed by both the tile manufacturer and tile installer. State grade, kind of tile, and identification marks for tile packages.
2. Material Certification: Furnish certificate issued and signed from manufacturers of mortars, adhesives, and grouts to certify that materials:
 - a. Are suitable for intended use.

- b. Meet or exceed the standard of American National Standards Institute and Tile Council of America.

1.5 QUALITY ASSURANCE

- A. Conform to TCA - Handbook for Ceramic Tile Installation.
- B. Conform to ANSI - American National Standard Specifications for the Installation of Ceramic Tile.
- C. Conform to ANSI - Recommended Standard Specifications for Ceramic Tile - TCA 137.1.

1.6 MAINTENANCE MATERIAL

- A. Provide extra quantity of ceramic tile under provisions of Division 1.
- B. Furnish extra materials equal to 2% of each type and color of ceramic tile supplied.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery:
 - 1. Deliver materials in manufacturer's original sealed containers with labels legible and intact identifying brand name and contents.
 - 2. Tile cartons grade-sealed by manufacturer in accordance with ANSI A137, with seals unbroken.
 - 3. Manufactured mortars and grouts shall contain hallmarks certifying compliance with reference standards and be types recommended by tile manufacturer for application.
 - 4. Adhesives in containers labeled with hallmark certifying compliance with reference standards.
 - 5. Deliver mastic grout ready for use.
- B. Storage and Handling:
 - 1. Store materials under cover in manner to prevent damage or contamination, as recommended by manufacturer.

1.8 JOB CONDITIONS

- A. Environmental:
 - 1. Temperature: Tile subcontractor shall comply with minimum temperature recommendations of the manufacturers for bonding and grouting materials. A minimum temperature of 60 degrees F shall be maintained during tile work and for seven days after completion.

2. Ventilation: Observe all manufacturer's "Safe-Handling", "Open-Flame" and "Ventilation Precautions". Use spark-proof fans when natural ventilation is questionable.
Important Notice: Temporary heaters must be vented to outside to eliminate any possible carbon dioxide damage to new tile work.
- B. Provide adequate lighting for the installation, grouting, and cleaning of the ceramic tile work.
- C. Protection: Protect adjoining work surfaces during tile work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Type and Manufacturer: Ceramic floor and wall tiles have been specified around standard products as manufactured by American Olean Tile Company or equal as approved by Architect.
- B. Other Acceptable Manufacturers:
 1. Dal-Tile Corporation, Dallas, TX.
 2. United States Ceramic Tile Company, East Sparta, OH.
 3. Winburn Tile Manufacturing Company, Little Rock, AR.
- C. Color and Pattern: As selected from manufacturer's full range.

2.2 MATERIAL

- A. General Requirements:
 1. Provide only ceramic floor tile and wall tile certified by the Tile Council of America (TCA) to equal or exceed the Standard Grade Requirements of TCA 137.1.
 2. When using setting and grouting materials manufactured under TCA license, provide such identification together with formula on each container.
 3. Provide materials obtained from only one source for each type of tile and color to minimize variations in appearance and quality.
- B. Factory Mounting:
 1. Factory mount ceramic tile into sheets of patterns selected.
 2. Type of mounting:
 - a. Mosaic Tile: Master-Set back-mounted sheets approximately 2 ft. x 1 ft., permanently aligned.

2.3 MATERIALS AND COMPONENTS FOR TILE FLOORS

A. Ceramic Floor Tile: Unglazed porcelain ceramic.

1. Conforming to Sections 5.1, ANSI A137.1.
2. Edges: Unglazed tile shall have "all-purpose" edges, and glazed tile shall have "cushion" edges.
3. Unglazed Ceramic Tile:
 - a. Nominal Face Size: 24 -inch x 24-inch as later selected by the Architect.
4. Nominal Thickness: 1/4-inch thick.
5. Colors: As indicated on the Finish Specifications drawing.
6. Ceramic Field Tiles: Refer to Finish Schedule drawing for color selections. Also reference the "A9" series drawings.

B. Ceramic Floor Tile: Unglazed porcelain ceramic.

1. Conforming to Sections 5.1, ANSI A137.1.
2. Edges: Unglazed tile shall have "all-purpose" edges, and glazed tile shall have "cushion" edges.
3. Unglazed Ceramic Tile:
 - a. Nominal Face Size: 12 -inch x 12-inch as later selected by the Architect.
4. Nominal Thickness: 1/4-inch thick.
5. Colors: As indicated on the Finish Specifications drawing.
6. Ceramic Field Tiles: Refer to Finish Schedule drawing for color selections. Also reference the "A9" series drawings.

C. Trim and Special Shapes:

1. Conforming to Section 5.1.2 and 6.2.2, ANSI A137.1.
2. Include bases, caps, stops, returns, trimmers and other required shapes to finish installation.
3. Color and Finish: As later selected by Architect.

D. Setting Materials:

1. Thinset Mortar: Thinset bond coat, ANSI A118.4, latex modified Portland cement mortar.
2. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A, TCA P601-01 and as specified below:
 - a. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter, comply with ASTM A185 and ASTM A82 except for minimum wire size.
 - b. Latex Additive: Styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gauging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed

Portland cement and aggregate mortar bed and Portland cement tile bonding coat.

- E. Shower Pan Liner
 - 1. Provide shower pan liner at shower areas Oatey Gray Flexible Shower Pan Liner PVC or approved equal.
 - a. 40 mil. PVC
 - b. Meets ASTM D4551
- F. Liquid Applied Bonded Waterproofing Membrane
 - 1. Provide liquid rubber and reinforcing fabric in slab depressions. Sides of depressions and up walls 6-inches.
 - 2. Hydrostatic resistance shall be 120 psi per ASTM D751.
 - 3. Breaking strength shall be 2400 psi per ASTM D751-89; 16.1 (cut strip method).
- G. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.
 - 1. Polymer Type: styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
- H. Non Slip Surfacing:
 - 1. 25% of tile flooring surface shall contain abrasive grain content.
 - 2. Use when showers and locker rooms are scheduled to receive ceramic tile flooring.
 - 3. Coefficient of friction must be greater than or equal to .5.
- I. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 - 1. Products:
 - a. Bonsal, W.R. Company; Grout Sealer.
 - b. Bostik; CeramaSeal Grout Sealer.
 - c. Mapei Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
 - d. Summitville Tiles, Inc; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

2.4 THRESHOLDS/TERMINATION STRIPS

- A. Stone Thresholds/Saddles:
 - 1. Material: Natural marble, ASTM A503, Grade A, uniform veining and color, polished finish on face, fabricated to sizes and profiles indicated or, if not shown, as required to provide transition between tile surface and adjoining finished floor surface, with minimum hardness of 10 in accordance with ASTM C241.
 - 2. Edges: Single or double beveled as required, 1/4-inch.
 - 3. Color(s): As later selected by Architect.

4. Thickness, slope and installation to be in conformance with ANSI and ADA accessibility guidelines.
- B. Metal Termination Strips:
 1. Manufacturer: Schluter
 2. Profile: Quadec
 3. Material: Stainless steel.
 4. Size: 1/8-inch wide top, with integral provisions for anchorage to mortar bed or substrate.

2.5 SEALANT JOINT MATERIALS

- A. Sealant: Provide sealant in change-of-plane and concrete control joints, specified sealant elsewhere.
- B. Joint Filler: Closed cell polyethylene foam or neoprene, round backer rod, compatible with sealant, size to control depth of sealant and to provide 20% to 50% compression upon insertion.
- C. Primer: Non-staining type as recommended by sealant manufacturer to suit application.

2.6 MIXING

- A. Mix and proportion pre-mix grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

- A. Examine surfaces to receive ceramic tile before installation begins to ensure surfaces fall within maximum variation:
 1. Maximum variation in subfloor surface: 1/4-inch in 10 ft.
 2. Maximum variation in vertical surface: 1/8-inch in 8 ft.
- B. Ensure surfaces are clean and well cured, and floors slope to drains.
- C. Report any unacceptable surfaces which do not comply with requirements indicated in the manufacturer's instructions and in ANSI A108.5, to the General Contractor, with copy to Architect.
- D. Do not tile such surfaces until they have been corrected and leveled to within above tolerances. Beginning work of this Section means "acceptance" of existing conditions and surfaces.

3.2 INSTALLATION - THIN-SET METHOD

A. General:

1. Install mortar bond coat, ceramic floor tile, grout, and movement joints, over slab on grade in accordance with manufacturer's instructions, ANSI A108.5, ANSI A108.10, ANSI A118.4, ANSI A118.6 and the TCA Handbook for Ceramic Tile Installation, Method F113.
2. Install mortar bond coat, ceramic base tile, grout, and movement joints over masonry or concrete wall surfaces in accordance with manufacturer's instructions, ANSI A108.5, ANSI A108.10, ANSI A118.4, ANSI A118.6 and TCA Handbook for Ceramic Tile Installation, Method W202.
3. Install mortar bond coat and stone thresholds/saddles in accordance with manufacturer's instructions, ANSI A108.5, and the TCA Handbook for Ceramic Tile Installation, Method TH611.
4. Install organic adhesive, ceramic wall tile, grout, and movement joints over gypsum wallboard or cementitious backer board surface in accordance with manufacturer's instructions, ANSI A136.1, ANSI A108.4, ANSI A108.10, ANSI A118.6, and the TCA Handbook for Ceramic Tile Installation, Methods W242.
5. Prior to tile layout, locations of any expansion or control joints in tile substrate shall be established for incorporation in the tile work.
6. Comply with manufacturer's instructions for the mixing and installation of proprietary material.

B. Tile Patterns and Colors: Lay all tile to patterns and colors as selected and indicated or shown on the "Color Schedule " furnished later by Architect, unless specific patterns or layouts are shown on the Contract Drawings. Reference Finish Schedule and Finish Specification Drawings.

C. Blend tile from no fewer than 6 boxes at a time due to the normal tone variations inherent in fired clay products.

D. Coverage and Termination: Carefully plan tile layouts. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Layout tile work and center tile fields in both directions in each space or on wall area. Adjust to minimize tile cutting.

E. Intersections and Returns: Neatly cut and fit tile tight to penetrations through tile. Accurately form intersections and returns. Perform cutting and drilling of tile work without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish or built-in items for straight aligned joints. Form internal base angles square and external angles bull-nosed.

F. Jointing Pattern: Align joints when adjoining tile of base, walls, and trim are same size. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size. Ensure joints are watertight, without voids, cracks, excess mortar or grout.

- G. Movement Joints: Locate tilework expansion joints and other sealant filled joints, including contraction, control, and isolation, directly over same joints occurring in the substrate. All control, construction, cold and seismic joints in the structure shall continue through the tilework and shall be of the same width. Provide sealant joints at all corners
 - 1. Keep joints free of mortar or grout.
 - 2. Joints must never be narrower than the substrate structural joint.
 - 3. Prepare joints and apply sealant to joints in accordance with TCA Method EJ171 and sealant manufacturer's instructions.
- H. Curing Set Tile: Allow tile to set for a minimum of 72 hours prior to grouting when temperature is low or humidity is high, and minimum 48 hours when hot, dry conditions exist. Check the bond strength carefully before grouting by sounding tile after setting. Remove and replace hollow sounding units.
- I. Grout tile joints. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- J. Finished Tile Work: Leave finished tile installations clean and free of cracked, chipped, broken, unbonded, or otherwise damaged or faulty tile units.

3.3 THRESHOLDS/TERMINATION STRIPS

- A. Stone Thresholds/Saddles: Set marble thresholds/saddles using 100% coverage of thin-set bond coat method, TCA TH611, at tile terminations and door openings.
- B. Metal Termination Strips: Install metal edge strips straight and level at tile terminations.

3.4 CLEANING

- A. Upon completion thoroughly clean tile surfaces; remove all grout haze, observing tile manufacturers recommendations as to use of chemical cleaners.
- B. Rinse all tile work thoroughly with clean water before and after using chemical cleaners.
- C. Polish surface of tile work with soft cloth.

3.5 PROTECTION

- A. Protect tile installation from traffic in accordance with ANSI and manufacturer's instructions. Protect tile work with Kraft paper, or other heavy covering, or application of a protective coat of neutral protective cleaner when recommended by tile manufacturer, during the construction period.

1. Protective Coatings: Before Final Inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.
- B. Prohibit all foot and wheel traffic from using newly tiled floors for no less than 7 days after installation.
- C. Board walkways shall be laid on floors that are to be continuously used by workmen.
- D. Tile floor areas to be trucked over shall have suitable continuous constructed plank runways of required width installed.
- E. Cracked, broken or damaged, or tile work which is out of line or level shall be removed and replaced.

END OF SECTION 093100

SECTION 095110 – SUSPENDED ACOUSTICAL CEILINGS

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
 - 1. Suspended metal ceiling grid system(s).
 - 2. Perimeter trim and accessories.
 - 3. Acoustical ceiling units, types as specified. Refer to "REFLECTED CEILING PLAN" for locations.
- B. Related Sections
 - 1. Division 21 Section - Fire Detection and Alarm System: Fire alarm components in ceiling system.
 - 2. Division 23 - Diffusers, Registers, and Grilles within ceiling system.
 - 3. Division 26 Section - Interior Lighting: Lighting fixtures within ceiling system.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C635 - Metal Suspension System for Acoustical Tile and Lay-In Panel Ceilings.
 - 2. ASTM C636 - Recommended Practices of Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 3. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 4. ASTM E84 - Surface Burning Characteristics of Building Materials.
 - 5. ASTM E1264 - Classification of Acoustical Ceiling Products.
- B. Underwriters Laboratories Inc. (UL):
 - 1. UL - Fire Resistance Directory and Building Material Directory.

1.4 SYSTEM DESCRIPTION

- A. Suspension system shall rigidly secure acoustical ceiling system, including integral mechanical and electrical components, with maximum deflection of 1/360.

1.5 SUBMITTALS

- A. Shop Drawings, Product Data and Samples: Submit in accordance with Division 1.
- B. Shop Drawings: Prior to delivery and installation, submit shop drawings clearly indicating:
 - 1. Grid layout with reflected ceiling plan of typical rooms and other spaces.
 - 2. Insert and hanger spacing and fastening details accompanied by catalog illustrations.
 - 3. Splicing method for main and cross runners.
 - 4. Change in level details.
 - 5. Acoustical unit support at ceiling fixtures.
- C. Product Data: Submit two copies of manufacturer's descriptive literature and recommended installation instructions and procedures.
- D. Samples: Deliver to job site, samples of each of the following:
 - 1. One of each type of acoustical unit showing specified texture, pattern, and exposed-to-view finish.
 - 2. One 12-inch length of runner, tees, intermediate support member, hanger wire, and edge and corner moldings.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of ceiling suspension systems and acoustical ceiling tile/panels with minimum five years experience.
- B. Installer Qualifications: Company specializing in installation of acoustical ceiling systems with minimum three years experience and approved by Ceiling Manufacturer.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of the applicable building code, for flammability classification of materials.
- B. Conform to UL Design No. indicated on drawings for ceiling-floor and/or ceiling-roof assembly.

1.8 MAINTENANCE MATERIAL

- A. Provide extra quantity of acoustical units under provisions of closeout section.
- B. Furnish extra materials equal to 2% of each type of acoustical units supplied.

- C. Maintenance Instructions: Submit manufacturer's recommendations for replacement, cleaning and refinishing of acoustical units. Include precautions against materials and methods detrimental to finish and acoustics efficiency.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Do not deliver materials to job site until building is ready for their installation.
2. Deliver materials in manufacturer's original, unopened protective packaging, with labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.

B. Storage and Handling:

1. Store and handle materials in original protective packaging to prevent soiling, physical damage or wetting.

C. Acclimate:

1. Not less than 24 hrs. before installation, store cartons of tile, open at each end, in areas to be installed to stabilize temperature and moisture content.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and humidity of 20 to 40 percent in areas where acoustical materials are to be installed, 24 hrs. prior to, during, and 24 hrs. after installation.

1.11 SEQUENCING/SCHEDULING

- A. Do not commence installation of acoustical ceilings until building is permanently, sufficient heat is provided, dust generating activities have terminated, and overhead mechanical and Electrical work is completed, tested, and approved.
- B. Schedule installation of acoustical systems after all interior wet work is dry and cured.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Suspension System(s):

1. Basis-of-Design Product: The design for acoustical ceiling suspension system(s), type(s) specified, are based on Armstrong World Industries,

Lancaster, PA. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

- a. Armstrong Commercial Ceilings
- b. USG Interiors, Inc., Chicago IL

B. Acoustical Unit(s):

- 1. Basis-of-Design: The design for acoustical units, type(s) specified, are based on Armstrong World Industries, Lancaster, PA. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

- a. Armstrong Commercial Ceilings
- b. USG Interiors, Inc. Chicago, IL

2.2 SUSPENSION SYSTEM(S)

A. Non-Fire Rated System (SS-1):

- 1. Type: Exposed tee grid, ASTM C635.
- 2. Structural Classification: Provide intermediate duty system main runner grid with equivalent cross tees and accessories.
- 3. Main, Cross, and Concealed Members:
 - a. Web Design: Double thickness with cap.
 - b. Material: Cold-rolled steel, hot dipped galvanized and steel cap with standard factory applied high-baked enamel finish, color(s) as selected by Architect.
 - c. Exposed Flange: 15/16-inch width.
 - d. Recycled Content: 25%.
- 4. Design: Armstrong's "Prelude XL" 15/16-inch exposed tee grid.

B. Non-Fire Rated System (SS-2):

- 1. Type: Exposed tee grid, ASTM C635.
- 2. Structural Classification: Provide intermediate duty system main runner grid with equivalent cross tees and accessories.
- 3. Main, Cross, and Concealed Members:
 - a. Web Design: Double thickness with cap.
 - b. Material: Aluminum construction with PVC face.
 - c. Exposed Flange: 15/16-inch width.
 - d. Recycled Content: 50%.
- 4. Design: Armstrong's "Clean Room" 15/16-inch exposed tee grid.

- C. Edge Molding: Minimum 0.017-inch cold-rolled steel, electro-galvanized, angle or channel shaped, minimum 15/16-inch flange width, with standard factory finish, color to match grid system, complete with internal and external corner caps.
- D. Special Moldings/Sections: In addition to standard manufactured edge moldings, ceiling contractor shall also provide any special fabricated moldings/sections required for special conditions where ceilings abut other elements.
- E. Accessories: Hold down clips (in all entry vestibules), splices, furring clips, and stabilizer bars as required to complete ceiling system and supplied by suspension system manufacturer.
- F. Provide concealed cross "TEE" and main runner anchor clips (Chicago Metallic # 1499) to secure same to edge molding. Exposed pop rivets are not permitted.
- G. Rough Suspension:
 - 1. Hanger Wire: Minimum 12 ga. galvanized, soft-annealed, mild steel wire.
 - 2. Wire Ties: 18 gage, galvanized annealed steel wire.
 - 3. Carrying Channels: 16 gage, 1-1/2 inch, cold-rolled steel.
- H. Ceiling Expansion Joint Cover
 - 1. Material: Flexible white vinyl filler.

2.3 ACOUSTICAL UNIT MATERIALS

- A. Acoustical Panel (ACT-1A): ASTM E1264, Type IV, Form 2, Pattern E, conforming to the following:
 - 1. Size: nominal 2-ft. by 2-ft.x 7/8"
 - 2. Edge Detail: Square lay-in.
 - 3. Surface Finish: Factory applied washable "White" vinyl latex paint.
 - 4. Style: Armstrong Ultima High NRC.
 - 5. Number: 1940 Square Lay-in
 - 6. "HumiGuard Plus" no sag warranty.
 - 7. Suspension System: SS-1.
- B. Acoustical Panel (ACT-1D): ASTM E1264, Type IV, Form 2, Pattern E conforming to the following:
 - 1. Size (nominal 2-ft. by 2-ft x 5/8"):
 - 2. Edge Detail: Square Lay-in.
 - 3. Surface Finish: Factory applied washable "White" vinyl latex paint.
 - 4. Style: Armstrong "Ceramaguard Fine Fissured - Perforated"
 - 5. Number: 607 Square Lay-in,
 - 6. "HumiGuard Plus" no sag warranty.
 - 7. Suspension System: SS-1.

2.4 ACCESSORIES

- A. Touch-Up Paint: Type and color required to match acoustical units and grid system.

PART 3 - EXECUTION

3.1 INSPECTION/COORDINATION

- A. Verify that all major above-ceiling work is completed.
- B. Coordinate the locations and installation of hangers with the work of other trades.
- C. Ensure the layout of hangers and carrying channels are located to accommodate fixtures and equipment which will be placed after the installation of ceiling grid system(s).
- D. Where ducts or other equipment prevent the regular spacing of hangers, provide "Unistrut trapezes.
- E. Coordinate mechanical and electrical fixtures/equipment to be incorporated into the suspended ceiling and grid system as indicated or as required.
 - 1. Provide four grid hanger wires at each lay-in light corner and at HVAC diffuser corners.
 - 2. All other items placed into lay-in grid: support of such items shall be by separate independent supports installed by the respective trades.

3.2 INSTALLATION - SUSPENSION SYSTEM

- A. Install fire rated ceiling system(s), when indicated, in accordance with applicable UL Design requirements.
- B. Install in accordance with ASTM C636 and manufacturer's recommendations to produce finished ceiling true to lines and levels and free from warped, soiled or damaged grid.
- C. Install ceiling system(s) in a manner capable of supporting all superimposed loads, with maximum permissible deflection of 1/360 of span and maximum surface deviation of 1/8-inch in 12 ft.
- D. In the absence of "Reflected Ceiling Plan(s)", lay out ceiling system(s) on room axis to a balanced grid design leaving equal border pieces no less than 50 percent of acoustical unit size.
- E. Rough Suspension:
 - 1. Hanger Clips on Inserts: Install as recommended by manufacturer.
 - 2. Hanger Wire: Space 4 ft. o.c., each direction unless specified otherwise.

3. Do not splay wires more than 5-inches in a 4 ft. vertical drop.
4. Wrap wire a minimum of three times horizontally, turning ends upward.
5. Saddle tie carrying channels to main structure for indirect hung suspension system, as appropriate.

F. Main and Cross Runners:

1. Space main runners at 4 ft. o.c., in direction of lighting pattern.
 - a. At right angle to carrying channel, wire clip to channels at intersections, if indirect suspension is required.
 - b. Level and square to adjacent walls.
2. Space cross runners at 2 ft. o.c.
3. Suspend grid system(s) independently of walls, columns, ducts, lighting fixtures, pipes and conduit.

G. Mechanical and Electrical Components: Where mechanical and electrical components are an integral part of the ceiling system, support such components by supplementary hangers attached to the grid system and located within 6 inches of each corner of such component. Extremely heavy components shall be supported independently of grid system.

H. Do not eccentrically load system, or produce rotation of runners.

I. Wall Molding:

1. Install wall molding at intersection of suspended ceiling and vertical surfaces.
2. Install inside and outside corner caps where wall moldings intersect, and preformed closers where bullnose corners occur matching edge molding.
3. Attach to vertical surface with mechanical fasteners using maximum lengths; straight, true to line and level.
4. Install hold-down clips on all lay-in units, to hold panels tight to grid system where air up-lift might occur, such as areas adjacent to exterior doors, and at all lay in units in a fire-rated ceiling system.

3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical ceiling units in strict accordance with manufacturer's printed installation instructions and recommended procedures.
- B. Install ceiling units level, in uniform plane, in straight line courses, and free from twist, warp and dents.
- C. Fit acoustic lay-in panels to bear all four sides on suspension members, free from damaged edges or other defects detrimental to appearance and function.
- D. Minimum width of border tiles: One-half unit dimension.

- E. Lay directionally patterned tile, as directed by Architect, with longest dimension of tile parallel to longest dimension of room, unless indicated otherwise on "Reflected Ceiling Plan(s)".
- F. Where bullnose concrete block corners, and other round obstructions occur, provide preformed closers to match edge molding.
- G. Hold-down Clips:
 - 1. Non-Rated System: Install to retain all panels, weighing less than 1 lb. per sq. ft., tight to grid system within 15 ft. of exterior doors and entrances and main Corridors.

3.4 CLEANING AND ADJUSTMENTS

- A. Clean soiled or discolored unit surface after installation.
- B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.
- C. Remove and replace damaged, uncleanable, or improperly installed units.
- D. Adjust any sags or twist which develop in the ceiling system(s).

END OF SECTION

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract," "Special Conditions," and "Division 1 – General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. Work of this Section includes complying with the requirements of Specification Section 01 8113 – Sustainable Design Requirements.
- B. Work of this Section includes complying with the requirements of Specification Section 01 8114 – Low Emitting Materials.
- C. Work of this Section includes complying with the requirements of Specification Section 01 8119 – Indoor Air Quality Management.

1.3 SUMMARY

- A. Section Includes:
 - 1. Luxury vinyl floor tile
- B. Related Sections include the following:
 - 1. Section 09 6530, "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tile.
 - 2. Section 09 6610, "Static-Control Resilient Floor Coverings" for resilient floor tile designed to control electrostatic discharge (ESD).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
 - 2. If tile has a pattern, indicate orientation of pattern.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Grade: Materials shall be Regular Grade, an industry standard which represents best quality production available.
- B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated. Installer shall have minimum five (5) years experience installing products similar to those required. Installer shall have documented experience of successfully completing three (3) projects of scope, schedule and complexity similar to this Project within the last two (2) years.
- C. Single Source Requirements: Supply each primary product required for Work of this Section from one (1) manufacturer. Accessory products including, for example, fasteners, sealants, and anchors shall be approved in writing by primary manufacturer.
- D. Certifications: Flooring must be certified as Floor Score or other LEEDv4 compliant certification. Flooring and adhesives must contain no added urea-formaldehyde resins.
- E. 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 mockups for floor tile including resilient base and accessories.
 - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Professional.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Professional specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile, resilient base, and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by

manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient 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 and resilient base during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient 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 tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 LUXURY VINYL FLOOR TILE

- A. Refer to Finish Schedule on Drawings for manufacturers, products, styles, and colors.

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 manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated. Adhesive shall be Urea-formaldehyde resin free.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
- D. Underlayment: Provide type recommended in writing by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions 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. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. 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.
- D. Do not install floor tiles and resilient base until they are same temperature as 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.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor 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 in pattern indicated.
- C. Match floor 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 in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor 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. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor 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.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile 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.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply floor polish in accordance with manufacturer's recommendations.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 6519

SECTION 096530 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall base. Molding accessories.

1.2 SUBMITTALS

- A. Product Data: For each 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 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. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. 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. Furnish not less than 10 linear feet for every 500 linear feet fraction thereof, of each type, color, pattern, and size of resilient product installed.

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

2.2 COLORS AND PATTERNS

- A. Colors and Patterns: As selected from manufacturer's full range. (Refer to Finish Schedule).

2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
 - 1. Johnsonite
 - 2. Armstrong World Industries, Inc
 - 3. Azrock Commercial Flooring, DOMCO
 - 4. Burke Mercer Flooring Products
 - 5. Roppe Corporation
- B. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic)
- C. Group (Manufacturing Method): I (solid, homogeneous)
- D. Style: Cove (with top-set toe) and Straight (toeless)
- E. Minimum Thickness: 0.125 inch
- F. Height: 4 inches
- G. Lengths: Coils in manufacturer's standard length
- H. Outside Corners: Premolded
- I. Inside Corners: Premolded
- J. Surface: Smooth.

2.4 MILLWORK RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
 - 1. Johnsonite (Basis of Design)
 - 2. Burke Mercer Flooring Products
 - 3. Roppe Corporation
- B. Type (Material Requirement): TP (rubber, thermoplastic).
- C. Style: Reveal 4.25" profile – 1/4" thick by 4.25" height wall base specify.
- D. Millwork profiles replicate the look of finely milled wood.
- E. Install in lengths as long as practicable.
- F. Job-formed corners:
 - 1. Outside corners: Use straight pieces of maximum lengths possible and miter corners to fit.
 - 2. Inside corners: Butt one piece to corner then scribe next piece to fit.
- G. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
- H. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
- I. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class B, Smoke less than 450.
- J. Accessories: Shoe Moulding profile – 1/4" thick by 1.5" height wall base.

2.5 ACCESSORY

- A. Description: Carpet edge for glue-down applications or Reducer strip for resilient floor covering Joiner for tile and carpet.
 - 1. Burke Mercer Flooring Products
 - 2. Johnsonite
 - 3. Roppe Corporation
- B. Material: Rubber
- C. Profile and Dimensions: As indicated on drawings.

2.6 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 manufacturers 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: 50 g/L.
 - b. Rubber Floor Adhesives: 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 for Stair Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. 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.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. 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 the same temperature as the space where they are to be installed.

- F. 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 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. 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.
- B. 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 096530

SECTION 096810 – TILE CARPETING

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract," "Special Conditions," and "Division 1 – General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

- A. Section includes:
 - 1. Modular, carpet tile.
 - 2. Static Control Carpet Tile.
- B. Related Sections:
 - 1. Section 09 6530 "Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-(300-mm-) long Samples.
- B. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.

2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

Shop Drawings: For static control carpet tile, also show:

1. Show layout of seams, edges and other conditions where joined or butted to adjacent materials.
2. Indicate method of joining seams and direction of carpet.
3. Indicate grounding schematics.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.7 QUALITY ASSURANCE

- A. Carpet manufacturer shall have been manufacturing commercial and/or contract carpet tile continuously for a period of 10 years.
- B. Installer Qualifications: An experienced installer who is certified by the International Certified Floor covering Installers Association at the Commercial II certification level. Installation shall be by installers approved in writing by manufacturer. It is recommended that, whenever possible, the firm shall be a member of the Floor Covering Installation Contractors Association (FCICA) or certified by the Floor Covering Installation Board (FCIB).
- C. Carpet manufacturer shall certify by register and roll numbers or M.O.# that carpet shipped for this project complies with all requirements of this Section subject to normal manufacturing tolerances.
- D. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Floor covering installation contractor shall visit the site and be responsible for all measurements and job conditions.
- E. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.
- F. After installation, continue to fresh air ventilate for 48 to 72 hours at normal room temperatures by operating the ventilation fan system at full capacity and by opening windows and doors, if possible.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty for Static Control Carpet Tiles: Carpet shall carry a 15-year Manufacturer's Warranty.
 - 1. Floor Covering Installation Contractor's Warranty: Submit a certificate guaranteeing the installation to be free of defects in workmanship for a period of one year. The certificate shall include the following statement: Installer shall, at his own expense and upon written notice from the Owner or his representative, promptly correct/replace any and all improper work and material that may become within (one) year after the date of final completion.

PART 2 -PRODUCTS

2.1 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Interface, Street Smart SS218.
 - 1. Equivalent Products shall be acceptable upon review and approval by the Architect and Owner.
- B. Color: Refer to drawings, Finish Legend.
- C. Pattern: Refer to drawings, Finish Legend.
- D. Construction: Tufted, textured loop.
- E. Style Name: Refer to drawings, Finish Legend.
- F. Size: As indicated on drawings.
- G. Performance Characteristics: As follows:
 - 1. Traffic Classification: Heavy
 - 2. Fiber Modification Ratio: 1.7 to 1.9
 - 3. Smoke Density: ASTM E 662 \leq 450.
 - 4. Flooring Radiant Panel: ASTM E-648
 - 5. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
 - 6. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

- H. Yarn Type: Post-Consumer Content Nylon
- I. Tufted Face Weight: 16 oz/yd²
- J. Finished Pile Height: 0.11"
- K. Average Density (Finished): 9,290 oz/yd²
- L. Standard Backing: CQuest GB

2.2 STATIC CONTROL CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Staticworx, Inc.
- B. Carpet tile shall be first quality of American manufacture and all yarn shall be of domestic origin.
- C. Color: Refer to drawings, Finish Legend.
- D. Pattern: Refer to drawings, Finish Legend.
- E. Static Control Fiber: Continuous Static Dissipative Staticworx denier helix fiber.
- F. Style Name: Refer to drawings, Finish Legend.
- G. Yarn System: 100% Recycled content Type 6 branded nylon.
- H. Yarn Manufacturer: Universal.
- I. Yarn Construction: Tufted Pattern Loop.
- J. Dye Method: 100% Solution Died.
- K. Dye Lots: Non-Mergeable.
- L. Manufacturing Process: Tufted.
- M. Gauge: 1/10 in.
- N. Tufted Stitches per inch: 12/in.
- O. Tufted Pile Height: 0.11 in.
- P. Tufted Yarn Weight: 16 oz/yd².
- Q. Pile Thickness: 0.062 in.
- R. Pile Density: 9,290 oz/yd².
- S. Fiber Modification Ratio: 1.7-1.9
- T. Traffic Rating: Heavy.
- U. Soil Stain Protection: Protekt.
- V. Preservative Protection: Intersept.
- W. Preservative Efficacy: 99% Reduction/No mold 7 days (AATCC 174 Parts 2&3).
- X. Electrical Resistance – ANSI/ESD S7.1, RTT, RTG:
 - 1. 1.0×10^6 Ohms Minimum, 1.0×10^9 Ohms Maximum (ANSI/ESD S7.1-2013)
 - 2. ANSI/ESD S20.20-2007:
 - a. ANSI/ESD S97.2 Voltage on a person < 100 volts when tested with approved conductive footwear system.
 - b. ANSI/ESD S97.1 System resistance < 3.5×10^7 Ohms.
- Y. Grounding: Groundable Path.
 - 1. Grounding Connector: 5mm, 26 gauge copper strip
 - 2. Grounding Frequency: 1 ground connector per 1000 square feet and minimum 1 per room.
- Z. Adhesive: Groundtack conductive, releasable adhesive for carpet tile.
- AA. Glue-free Installation: Use GroundBridge underlayment with Interface TacTiles.
- BB. Crockfastness: AATCC Test Method 165 Minimum stain rating on International Grey Scale of not less than 5 wet and dry.

- CC. Atmospheric Fading AATCC Test Method 129 Ozone/AATCC Test Method 23, Burned Gas shall not be less than 3 on International Grey Scale after two cycles on each test.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Provide adhesives approved and/or recommended by carpet manufacturer.

PART 3 -EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 03 3000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Carpet shall be installed in strict accordance with manufacturer's written instructions and recommendations. Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive]
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, and thresholds. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.
- H. Grounding: Copper grounding strips shall be placed approximately 25' to 40' apart throughout the installation or accessible to all I-beams or other designated building or electrical ground. The copper strip shall be installed at least every 1,000 square feet or 1 ground strip per room minimum.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

3.5 TESTING AND CERTIFICATION

- A. Upon project completion, the manufacturer or the manufacturer's designated representative shall test the resistive properties of the floor using an ohmmeter per the test method ANSI/ESD S7.1-2013. Resistance measurements shall be performed from the surface of tiles to the groundable point and from one point on the tile surface to a second point on the same tile surface. The test results shall be confirmed in writing certifying that the flooring resistance properties measure in the static dissipative range (no less than 1.0×10^6 and no greater than 1.0×10^{10}). The certification letter shall reference compliance with space specified recognized grounding standards.
1. ANSI/ESD S20.20-2014: For static sensitive parts handling in electronics manufacturing.
 2. Motorola R56: Telecommunication applications, Mission Critical Command Centers, 9-1-1 call centers, Dispatcher positions.
 3. ATIS 0600321-2010: Alliance of Telecommunications Industry Standards.

END OF SECTION 09 6810

SECTION 098433.11 SOUND-ABSORBING WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound-absorbing wall panels, custom-fabricated and fabric-finished.

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Surface Burning Characteristics (ASTM E84):
 - a. Flamespread: 25 maximum.
 - b. Smoke Developed: 450 maximum.
 - c. Fire ratings for all fabric covered panels is based on testing of the panel wrapped with the standard in-stock fabric, Guilford of Maine, FR 701 Style 2100.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, edge profiles and panel components, including anchorage, accessories, finish colors and textures.
- D. Samples: Submit selection and verification samples of finishes, colors and textures.
- E. Test Reports: Certified test reports showing compliance with specified performance requirements.
 - 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with Division 1 Product Requirements Section.

- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install panels until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees F (16 - 27 degrees C) and 35% MINIMUM RH and 55% MAXIMUM RH, respectively. All products constructed with wood or wood fiber content must be stored for at least 72 hours in the controlled environment specified herein prior to installation to allow the materials to stabilize.

PART 2 PRODUCTS

2.01 SOUND-ABSORBING WALL PANELS

- A. Manufacturer: Kinetics Noise Control, Inc.
 - 1. Contact: PO Box 655, 6300 Irelan Place, Dublin, OH 43017; Telephone: (614) 889-0480; Fax: (614) 889-0540; E-mail: intsales@kineticsnoise.com; Web site: www.kineticsnoise.com.
- B. Substitutions: Refer to Division 01 Product Substitutions.

2.02 MANUFACTURED UNITS

- A. High Impact HardSide Panels:
 - 1. Thickness: 1 1/8 inches.
 - 2. Size: As indicated on the drawings up to a maximum 48 inches x 120 inches panel.
 - 3. Core: 1 inch thick fiberglass, 6 - 7 pcf (96 - 112 kg/m³) density, with bonded facing layer of, 1/8 inch thick impact resistant fiberglass.
 - 4. Edge Detail: Mitered hardened with a Class A hardening solution.
 - 5. Facing: [100% polyester fabric, FR 701 Style 2100 by Guilford of Maine] [Factory approved customer selected fabric]. Designer selected fabrics must be approved by the panel manufacturer as acceptable quality for wrapping and covering core materials. Some fabrics are unstable, too stiff, or lack the weight and thread density for producing an acceptable finish product.
 - a. Color: As selected from fabric manufacturer's full range of colors.
 - 6. Sound Absorption (ASTM C423): Noise Reduction Coefficient as follows:
 - a. 1-1/8 inches panel: 1.00, minimum.
 - 7. Mounting Accessories: Z-clips.

2.03 FABRICATION

- A. Wrap panel edges and return facing fabric 1 - 2 inches on back of panel. Secure fabric with adhesive applied to edges and back of panel only.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
 - 1. Verify that stud spacing is 16 inches o.c., maximum, for panels installed over open studs.
 - 2. Do not install panels until unsatisfactory conditions are corrected.

3.03 CLEANING

- A. Follow manufacturer's instructions for cleaning panels soiled during installation. Replace panels that cannot be cleaned to as new condition.
- B. Keep site free from accumulation of waste and debris.

END OF SECTION 098433.11

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SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 051250 Architecturally Exposed Structural Steel, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.
 - 2. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or

equal from PPG PAINTS. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups 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.
 - b. Other Items: Architect will designate items or areas required.
 - 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. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg. F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg. F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg. F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance of requirements, products by PPG Paints are the basis of design and set the standard of quality required.
 - 1. PPG Paints (basis of design).
 - a. Chuck Bleakley CSI, CDT, LEED®-AP p: 484.363.0417 e: chuck.bleakley@ppg.com
 - 2. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. 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.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Total VOC content will not be increased by tints and colorants required.
- D. Colors: As selected by Architect from manufacturer's full range.

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.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- B. Clean substrates of substances that could impair bond of paints, 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 paint systems indicated.
- C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer. Refer to Section 051250 Architecturally Exposed Structural Steel for additional steel substrate preparation requirements.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces. Refer to Section 051250 Architecturally Exposed Structural Steel for additional steel substrate preparation requirements.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.
- I. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 SCHEDULE - EXTERIOR SURFACES – LATEX

- A. Total VOC content will not be increased by tints and colorants required.
- B. Shop Primed Ferrous Metal: Semi-Gloss Acrylic Enamel:
 - 1. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal Primer.
 - b. Finish coats: Two coats Pro Industrial DTM Acrylic semi-gloss, B66 series.
 - 2. PPG Paints
 - a. Primer: Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series.
 - b. Finish Coats: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- C. Ferrous Metal: Semi-Gloss Acrylic Enamel:
 - 1. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal Primer.
 - b. Finish: Two coats Pro Industrial DTM Acrylic semi-gloss, B66 series.

2. PPG Paints
 - a. Primer: Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series.
 - b. Finish Coats: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- D. Galvanized Metals: Semi-gloss Acrylic Enamel: Pretreat as required by manufacturer.
1. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal Primer.
 - b. Finish: Two coats Pro Industrial DTM Acrylic semi-gloss, B66 series.
 2. PPG Paints
 - a. Primer: Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series.
 - b. Finish Coats: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- E. Wood and Composite Siding (cementitious types) Flat Acrylic: For factory primed composite siding, primer may be omitted.
1. Sherwin-Williams:
 - a. Composite Siding Primer: One coat Loxon Exterior Masonry Acrylic Primer.
 - b. Wood Primer: One coat Exterior Latex Wood Primer.
 - c. Finish: Two coats A-100 Exterior Latex Flat, A6.
 2. PPG Paints
 - a. Composite Siding Primer: One Coat Perma-Crete® Int/Ext Alkali Resistant Primer 4-603 series
 - b. Wood Primer: One Coat SPEEDHIDE® Exterior Latex Wood Primer 6-609 series.
 - c. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI series.
- F. Wood and Composite Siding: Semi-Gloss Acrylic: For factory primed composite siding, primer may be omitted.
1. Sherwin-Williams:
 - a. Composite Siding Primer: One coat Loxon Exterior Masonry Acrylic Primer.
 - b. Wood Primer: Wood Primer: One coat Exterior Latex Wood Primer.
 - c. Finish: Two coats A-100 Gloss.
 2. PPG Paints
 - a. Composite Siding Primer: One Coat Perma-Crete® Int/Ext Alkali Resistant Primer 4-603 series

- b. Wood Primer: One Coat SPEEDHIDE® Exterior Latex Wood Primer 6-609 series.
 - c. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI series.
- G. Wood and Plastic, Previously Painted: High Gloss Latex Enamel:
 - 1. Sherwin-Williams:
 - a. Primer: One coat Multi-Purpose Primer, B51.
 - b. Finish: Pro Industrial High Performance Acrylic gloss, B66-600 Series.
 - 2. PPG Paints
 - a. Primer: One Coat SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series.
 - b. Finish Coats: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- H. Wood and Plastic, New: High Gloss Latex Enamel:
 - 1. Sherwin-Williams:
 - a. Wood Primer: One coat A-100 Latex Wood Primer.
 - b. PVC Plastic Primer: One coat Multi-Purpose Primer, B51.
 - c. Finish: Pro Industrial High Performance Acrylic gloss, B66-600 Series.
 - 2. PPG Paints
 - a. Wood Primer: Wood Primer: One Coat SPEEDHIDE® Exterior Latex Wood Primer 6-609 series.
 - b. PVC Plastic Primer Primer: One Coat SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series.
 - c. Finish: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- I. Gypsum Board, Siding: Flat Acrylic:
 - 1. Sherwin-Williams:
 - a. Primer: One coat Exterior Latex Wood Primer B42 W41.
 - b. Finish: Two coats A-100 Exterior Latex Flat.
 - 2. PPG Paints
 - a. Primer: One Coat SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series.
 - b. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Flat 6-610XI series.
- J. Concrete and Concrete Masonry Units: Semi-Gloss Acrylic:

1. Sherwin-Williams:
 - a. Filler: One coat Prep Rite Interior/Exterior Block Filler B25 W25.
 - b. Finish: Two coats A-100 semi-gloss, A8.
 2. PPG Paints
 - a. Filler: One Coat SPEEDHIDE® Int/Ext Masonry Hi Fill Latex Block Filler 6-15 series.
 - b. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Semi-Gloss 6-900XI series.
- K. Gypsum Board, Cement Plaster: Satin Acrylic:
1. Sherwin-Williams:
 - a. Primer: One coat Exterior Latex Wood Primer.
 - b. Finish: Two coats A-100 Exterior Latex Satin.
 2. PPG Paints
 - a. Primer: One Coat SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series.
 - b. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Satin 6-2045XI series.
- L. Gypsum Board, Cement Plaster: Semi-Gloss Acrylic:
1. Sherwin-Williams:
 - a. Primer: One coat Exterior Latex Wood Primer.
 - b. Finish: Two coats A-100 Gloss, A8.
 2. PPG Paints
 - a. Primer: One Coat SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series.
 - b. Finish: Two Coats SPEEDHIDE® Exterior 100% Acrylic Latex Semi-Gloss 6-900XI series.
- M. Concrete: Elastomeric fine texture:
1. Sherwin-Williams:
 - a. Primer: One coat Loxon Concrete and Masonry Primer A24.
 - b. Finish: Two coats Con-Flex XL Textured High Build Coating, A5-800 Series.
 2. PPG Paints
 - a. Primer: PERMA-CRETE® LTC Concrete Block & Masonry Surfacer/Filler 4-100 series

- b. Finish: Two Coats PERMA-CRETE® PITT-FLEX® Elastomeric Coating – Smooth 4-110 series.

3.7 SCHEDULE - EXTERIOR SURFACES - HIGH PERFORMANCE

A. Shop Primed Ferrous Metal: Gloss Urethane:

1. Sherwin-Williams:

- a. Primer: One coat Kem Bond HS Primer B50.
- b. Finish: Two coats Hi-Solids Polyurethane B65.

2. PPG Paints

- a. Primer MULTIPRIME® Low VOC Quick Dry Universal Primer 97-680 series
- b. Finish: Two Coats PITTHANE® ULTA Gloss Urethane Enamel 95-812 series.

B. Ferrous Metals: Gloss Urethane:

1. Sherwin-Williams:

- a. Primer: One coat Recoatable Epoxy Primer B67.
- b. Finish: Two coats Hi-Solids Polyurethane B65.

2. PPG Paints

- a. Primer: One Coat Amerlock 2VOC High Solids Epoxy Coating
- b. Finish: Two Coats PITTHANE® ULTA Gloss Urethane Enamel 95-812 series.

C. Galvanized Metals: Gloss Urethane:

1. Sherwin-Williams:

- a. Primer: One coat Macropoxy HS primer B58.
- b. Finish: Two coats Hi Solids Polyurethane B65.

2. PPG Paints

- a. Primer: One Coat Amerlock 2VOC High Solids Epoxy Coating
- b. Finish: Two Coats PITTHANE® ULTA Gloss Urethane Enamel 95-812 series.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 051250 Architecturally Exposed Structural Steel, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.
 - 2. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or

equal from PPG Paints. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups 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.
 - b. Other Items: Architect will designate items or areas required.
 - 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. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance of requirements, products by Pittsburg Paints Company are the basis of design and set the standard of quality required, unless noted otherwise.
 - 1. The Pittsburg Paints Company (basis of design).
 - 2. Sherwin-Williams Company (The).
 - 3. Miniwax PolyShades.

2.2 PAINT, GENERAL

- A. 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.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Total VOC content will not be increased by tints and colorants required.
- D. Colors: As selected by Architect from manufacturer's full range.

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.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, 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 paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer. Refer to Section 051250 Architecturally Exposed Structural Steel for additional steel substrate preparation requirements.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces. Refer to Section 051250 Architecturally Exposed Structural Steel for additional steel substrate preparation requirements.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.

- f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
- 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. 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.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 SCHEDULE - INTERIOR SURFACES - LATEX

- A. Total VOC content will not be increased by tints and colorants required.
- B. Shop Primed Ferrous Metal: Semi-Gloss Finish:
 - 1. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal primer.
 - b. Finish: Two coats Pro Industrial High Performance Acrylic, semi-gloss.
 - 2. The Pittsburgh Paints Company:
 - a. Primer: Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series
 - b. Finish: Two Coats Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series
- C. Ferrous Metal and Galvanized Metals: Semi-Gloss Finish:
 - 1. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal primer.
 - b. Finish: Two coats Pro Industrial High Performance Acrylic, semi-gloss.
 - 2. The Pittsburgh Paints Company:
 - a. Primer: Epoxy primer, PPG 95-245 Series Pitt-Guard Rapid Coat DTR Polyamide Epoxy Coating.
 - b. Finish: Two coats Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils, PPG 95-8800 Series Pitthane High Build Semi-Gloss Urethane Enamel.
- D. Concrete Masonry Units (CMU): Semi-Gloss Finish:
 - 1. Sherwin-Williams:
 - a. Filler: One coat PrepRite Interior/Exterior Block Filler B25W25.
 - b. Finish: Two coats ProMar 200 Zero VOC with anti-microbial, semi-gloss.
 - 2. The Pittsburgh Paints Company:
 - a. Primer: One Coat SPEEDHIDE® Int/Ext Masonry Hi Fill Latex Block Filler 6-15 series
 - b. Finish: Two Coats SPEEDHIDE® zero Int Zero-VOC Latex Semi-Gloss 6-4510XI series
- E. Exposed Metal Deck & Joists: Flat Acrylic:

1. Sherwin-Williams:
 - a. Finish: One coat Low VOC Waterborne DryFall, Flat.
 2. The Pittsburgh Paints Company:
 - a. Primer: spot prime with Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series as needed
 - b. Finish: Two Coats SPEEDHIDE® Int Dry-Fog Spray Paint Flat latex 6-715XI series
- F. Gypsum Board: Flat Finish:
1. Sherwin-Williams:
 - a. Primer: One coat. ProMar 200 Zero VOC Primer.
 - b. Finish: Two coats. ProMar 200 Zero VOC with anti-microbial, Flat.
 2. The Pittsburgh Paints Company:
 - a. Primer: One Coat SPEEDHIDE® zero Int Zero-VOC Latex Sealer 6-4900XI series
 - b. Finish: Two Coats SPEEDHIDE® zero Int Zero-VOC Latex Flat 6-41110XI series
- G. Gypsum Board: Eggshell Finish:
1. Sherwin-Williams:
 - a. Primer: One coat ProMar 200 Zero VOC Primer.
 - b. Finish: Two coats ProMar 200 Zero VOC with anti-microbia,Eg-Shel.
 2. The Pittsburgh Paints Company:
 - a. Primer: One Coat SPEEDHIDE® zero Int Zero-VOC Latex Sealer 6-4900XI series
 - b. Finish: Two Coats SPEEDHIDE® zero Int Zero-VOC Latex Eggshell 6-4310XI series
- H. Gypsum Board: Semi-Gloss Finish:
1. Sherwin-Williams:
 - a. Primer: One coat ProMar 200 Zero VOC Primer.
 - b. Finish: Two coats ProMar 200 Zero VOC with anit-microbial, semi-gloss.
 2. The Pittsburgh Paints Company:
 - a. Primer: One Coat SPEEDHIDE® zero Int Zero-VOC Latex Sealer 6-4900XI series

- b. Finish: Two Coats SPEEDHIDE® zero Int Zero-VOC Latex Semi-Gloss 6-4510XI series
 - I. Gypsum Board Under Vinyl Wall Covering: Latex Primer:
 - 1. Sherwin-Williams:
 - a. One coat: Multi-Purpose Primer.
 - 2. The Pittsburgh Paints Company:
 - a. One Coat: SEAL GRIP® Int/Ext Acrylic Universal Primer/Sealer 17-921 series
 - J. Wood: Semi-Gloss Finish – 100% acrylic:
 - 1. Sherwin-Williams:
 - a. Primer: Not required.
 - b. Finish: Two coats Solo 100% Acrylic, semi-gloss.
 - 2. The Pittsburgh Paints Company:
 - a. Primer: not required
 - b. Finish: DEFT258 Semi-Gloss Polyurethane WB series
 - K. Wood: Stain Finish – Oil Base:
 - 1. Miniwax PolyShades:
 - a. Stain: Three (3) coats.
 - b. Color: As selected by Architect.
 - L. Concrete: clear penetrating sealer
 - 1. Sherwin-Williams:
 - a. Primer: Not required.
 - b. Finish: Single flood coat Loxon 7%
 - 2. The Pittsburgh Paints Company:
 - a. Primer: not required
 - b. Finish: single flood coat PERMA-CRETE® Aqua-Pel™ Clear Water Repellent 4-6100 series
 - M. Waterbased Intumescent Coating
 - 1. Sherwin-Williams:

- a. Finish: FIRETEX FX5120 waterbased thin film intumescent protection coating for use on interior exposed structural steel substrates. (1 HOUR PROTECTION required where indicated on drawings).

END OF SECTION 099123

SECTION 099733 - CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of the Construction Contract," "Special Conditions," and "Division 1 – General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. Work of this Section includes complying with the requirements of Specification Section 01 8113 – Sustainable Design Requirements.
- B. Work of this Section includes complying with the requirements of Specification Section 01 8114 – Low Emitting Materials.
- C. Work of this Section includes complying with the requirements of Specification Section 01 8119 – Indoor Air Quality Management.

1.3 SUMMARY

- A. Section Includes:
 - 1. Concrete sealer for:
 - a. Uncured concrete floors.
 - b. Cured concrete floors.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Provide data on specified products, describing physical and performance characteristics.
- B. Manufacturer's Installation Instructions:
 - 1. Submit surface preparation and application instructions.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept concrete sealer on site in manufacturer's original unopened containers. Inspect for damage.
- B. Protect concrete sealer from freezing.

1.7 PROJECT CONDITIONS

- A. Do not install concrete sealer when air temperature or concrete surface temperature is less than 40 degrees F.
- B. Maintain concrete floor surface temperature above freezing during and after installation of concrete sealer until sealer is cured.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
 - 1. Mar-flex: SurfiSeal.
 - 2. Curecrete Chemical Company; Ashford Formula.
 - 3. The Euclid Chemical Company; Euco Diamond Hard.
 - 4. L&M Construction Chemicals, Inc.; Seal Hard.
- B. Concrete Sealer: Clear, penetrating, reactive VOC compliant, waterborne silicate compound designed to densify and seal concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION - UNCURED CONCRETE FLOORS

- A. Verify final troweling is complete.
- B. Verify concrete is set sufficiently so application of concrete sealer will not mar concrete surface.

3.2 EXAMINATION - CURED CONCRETE FLOORS

- A. Verify floor surfaces are free of substances that may impair penetration of concrete sealer.

3.3 PREPARATION - CURED CONCRETE FLOORS

- A. Remove membrane forming curing compounds and other surface contaminants capable of impairing concrete sealer penetration into concrete.
- B. Remove contaminants by chemical or mechanical means as recommended by concrete sealer manufacturer.
- C. Allow floor to dry. Broom clean floor surface to remove loose dust and dirt.

3.4 INSTALLATION - UNCURED CONCRETE FLOORS

- A. Apply concrete sealer in accordance with manufacturer's instructions immediately after final troweling.
- B. Keep floor surface wet with concrete sealer for minimum 30 minutes.
- C. Broom concrete sealer as required for uniform coverage on floor surface.
- D. Remove excess liquid material from floor surface.
- E. Saw Cut Floor Joints: Treat joints after cutting as specified in Section 033000 "Cast-In-Place Concrete."
 - 1. Remove cement dust from joints and floor surface.
 - 2. Treat saw cut joints by flooding with concrete sealer.
 - 3. When curing is complete, clean joints in preparation for sealant application as specified in Section 079200 "Joint Sealants."

3.5 INSTALLATION - CURED CONCRETE FLOORS

- A. Apply concrete sealer in accordance with manufacturer's instructions.
- B. Keep floor surface wet with concrete sealer for minimum 30 minutes.
- C. Scrub concrete sealer into concrete surface with mechanical scrubbers.
- D. Remove excess liquid material from floor surface.
- E. Rinse floor when required to remove excess concrete sealer.

3.6 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on floor finish for 8 hours after installation.

3.7 CLEANING

- A. Remove concrete sealer residue from floor surface.

END OF SECTION 09 9733

SECTION 101100 - VISUAL DISPLAY UNITS

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. Markerboards.
 - 2. Markerboards with Doors

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For visual display surfaces. 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. Lined Markerboards (markerboards with permanent "staff" lines).

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.

2.2 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Magnetic Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, magnetic core material, and porcelain-enamel face sheet with High-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
 - 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. Marsh Industries, Inc.; Visual Products Group.
 - c. Platinum Visual Systems; a division of ABC School Equipment, Inc.
 - 2. Manufacturer's Standard Core: Minimum 1/4-inch thick, with manufacturer's standard moisture-barrier backing.
 - 3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
 - 4. Refer to Drawings for Music Rooms. Markerboard Assemblies in music rooms to be lined with appropriate music lines (staff).
- B. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch thick, extruded aluminum; of size and shape indicated on Drawings.
 - 1. Aluminum Finish: Clear anodic finish.
 - a. Color: As selected by Architect from full range of industry colors and color densities.

- C. Chalktray: Manufacturer's standard; continuous.
 - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- D. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
 - 1. Size: Length indicated on Drawings.
 - 2. Map Hooks: Two map hooks for every 48 inches of display rail or fraction thereof.
 - 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
 - 4. Flag Holder: One for each room.
 - 5. Tackboard Insert Color: As selected by Architect from full range of industry colors.
 - 6. Aluminum Color: Match finish of visual display assembly trim.
- E. Paper Holder Display Rail: Extruded aluminum; designed to hold paper by clamping action.

2.3 MARKERBOARD WITH DOORS

- A. Markerboard Panel with Doors: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, magnetic core material, and porcelain-enamel face sheet with High-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive with double door hinged wood doors and wood frame.
 - 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. Global Industrial
 - 2. Size: 48 inch x 48 inch x 4 inch
- B. Frames and Trim: Wood per manufacturer construction.
 - 1. Wood Frame: Oak laminate surface

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, 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, as indicated on approved Shop Drawings.
 - 2. Where size of visual display board assemblies 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.
- C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

END OF SECTION 101100

SECTION 101400 – INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of the Construction Contract,” “Special Conditions,” and “Division 1 – General Requirements” form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.2 SECTION INCLUDES

- A. Room Identification signage.

1.3 REFERENCES

- A. ANSI 117.1 – For Buildings and Facilities
- B. ASTM International (ASTM) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM International (ASTM) D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide photopolymer signage that conforms to the requirements of all regulatory agencies holding jurisdiction.
- B. Requirements:
 - 1. Comply with all applicable provisions of the ADA and ANSI A117.1-1998.
 - 2. Character Proportion: Letters and numbers on signs must have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.
 - 3. Color Contrast: Characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.
 - 4. Raised Characters or Symbols: Letters and numbers on signs must be raised 1/32 in (0.8 mm) minimum and be sans serif characters. Raised characters or symbols must be at least 5/8 in (16 mm) high, but no higher than 2 in (50 mm). Symbols or pictograms on signs must be raised 1/32 in (0.8 mm) minimum.
 - 5. Symbols of Accessibility: Accessible facilities required to be identified must use the international symbol of accessibility.
 - 6. Braille: Grade II with accompanying text.
- C. Fire Performance Characteristics:
 - 1. Provide photopolymer signage with surface burning characteristics that consist of a flame spread of 75 and a smoke development of 120

when tested in accordance to UL 723 (ASTM E 84).

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation methods.
- B. Shop Drawings:
 - 1. Detail drawings showing sizes, lettering and graphics, construction details of each type of sign and mounting details with appropriate fasteners for specific project substrates.
 - 2. Plan drawing showing signage location relative to room door or storefront.
- C. Selection Samples: For each finish product specified, two sets of color sheets representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each sign type and color specified, one sample, minimum size 6 inches (150 mm) square, representing actual product, color and patterns.
- E. Manufacturer's Installation Instructions: Printed installation instructions for each signage system.
- F. Message List: Signage report indicating associated room name and number per project plans, signage location, sign text (room name, information and number), and sign type.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in unopened factory packaging.
- B. Inspect materials at delivery to verify there are no defects or damage.
- C. Store products in manufacturer's original packaging until ready for installation, in climate controlled location away from direct sunlight.
- D. 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. Install products in an interior climate-controlled environment.
- B. 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.

1.8 WARRANTY

- A. At project closeout, provide to the Department or Department's representative a copy of the manufacturer's standard limited warranty against manufacturing defect outlining the terms, conditions and exclusions from coverage.

- 1. Duration: One (1) year from Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: 2/90 Sign Systems, 5350 Corporate Grove Blvd SE, Grand Rapids, MI 49512, phone 800-777-4310.

- 1. Equivalent products from ASI and Innerface shall be acceptable.

- B. Provide all signage from one manufacturer, including necessary mounting options, fittings and fasteners.

2.2 SIGNAGE – GENERAL

- A. It is the intent of these specifications to establish a sign standard for the Department including but not limited to primary room identification, restrooms, conference rooms, and all code compliant signage. The signage contractor shall design and submit approval drawings for all sign types relevant to the project.
- B. Comply with all applicable provisions of the ADAAG and ANSI A117.1 codes that apply to the State and Local jurisdiction of the project.
- C. Typography: See Drawings. Copy shall be a clean and accurate reproduction of typeface(s) specified. Upper and lower case and all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be set by manufacturer.
- D. Arrows, symbols and pictograms will be provided in style, sizes, colors and spacing as indicated in drawings for each sign system.
- E. Braille
 - 1. Grade 2 Braille
- F. Design
 - 1. Text/Graphics Placement: As indicated on Drawings
 - 2. Font: As indicated on drawings
 - 3. Signage Profile and Frame pieces:
 - a. Based on 2/90 Modular system

2.3 IDENTIFICATION SIGNAGE

- A. System: 2/90 MODULAR: Interchangeable Component Sign

- B. ADA Plate Color Selection – To be selected by Professional from manufacturer standard selections.
- C. Insert Background Color Selection: To be selected by Professional from manufacturer standard color selections.
- D. Raised Copy Color Selection: To be selected by Professional from manufacturer standard color selections.
- E. Insert Copy Color Selection: To be selected by Professional from manufacturer standard color selections.
- F. Insert Font Selection
 - 1. Font: As indicated on the Contract Drawings. (FUTURA)
- G. Sign Type: Reference contract drawings.
- H. Frame Piece – Aluminum, 1" x specified size of sign, clear anodized; to match existing condition profile.
- I. Mounting
 - 1. For opaque walls, provide double face tape and silicone mount.
 - 2. For glass walls, provide double face tape and silicone mount with coordinating color backer plate on opposite side of glazing.

2.4 SIGNAGE SCHEDULE

- A. Room signs: Furnish one sign for each interior door listed on the door schedule and at all cased openings into spaces.
- B. Reference Drawings for Signage schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall surface is dry and free from dirt, grease and loose paint.
- B. Complete all finishing operations, including painting, before beginning installation of signage systems.
- C. Do not begin installation until substrates have been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify Professional of unsatisfactory preparation before proceeding.
- E. Examine signage for defects prior to installation. Do not install damaged signage.

3.2 PREPARATION

- A. Verify mounting heights and locations comply with referenced standards.
- B. Clean surfaces thoroughly prior to installation to remove dust, debris and loose particles.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.

3.3 INSTALLATION

- A. Locate the signage system as indicated on drawings for the appropriate substrate and in accordance with manufacturer's installation instructions.
- B. Install signage systems level and plumb at the height indicated on the drawings.
- C. Mount in accordance with current ADA and State regulations.
- D. Provide BLANK back plate for all signage mounted to glass.

3.4 CLEANING

- A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION 10 1400

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SECTION 101416 – PLAQUES

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 plaques.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.
- C. Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plaques to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 PLAQUES

- A. Etched Stainless Steel Plaque: Plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 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. Impact Signs Inc. 26 E. Burlington Ave. LaGrange, IL 60525
 - b. Or approved equal.
 - 2. Plaque Material: Stainless Steel
 - 3. Plaque Thickness: 1/4 inch.
 - 4. Etching depth: .020"
 - 5. Finishes:
 - a. brushed
 - 6. Background Texture/Color: As selected by Architect from manufacturer's full range.
 - 7. Mounting: Solid Wall Mount – No Rosette.
 - 8. Text and Typeface: Typeface as selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use screws and bolts with tamper-resistant slots unless otherwise indicated.
 - 2. Plaque Mounting Fasteners:
 - a. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

2.4 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
 - 1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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 plaque work.

- B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
 - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
 - 1. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as plaques are installed.
- C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

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 and Interior Cast Aluminum Characters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
- C. Samples: For each type of exposed component, and exposed finish.
- D. Delegated-Design Submittal:
 - 1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
- 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design sign structure and anchorage of dimensional character sign types to withstand design loads as indicated on Drawings.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles.
 - 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. ACE Sign Systems, Inc.
 - b. APCO Graphics, Inc.
 - c. A. R. K. Ramos Signage Systems.
 - d. Gemini Incorporated.
 - e. InPro Corporation.
 - f. Nelson-Harkins Industries.
 - g. Southwell Company (The).
 - 2. Character Material: Cast Aluminum.
 - 3. Character Height: 12 inches exterior, 8 inches interior.
 - 4. Thickness: 3/4 inches.
 - 5. Finishes: Brushed aluminum.
 - 6. Mounting: Concealed studs.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish nonferrous-metal, stainless-steel or hot-dip galvanized devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 2. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

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SECTION 101453 – TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the General Provisions apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

- A. Furnish all labor, materials, equipment and services necessary for and reasonably incidental to complete the site signs work as indicated on drawings or specified, including but not limited to the following:
 - 1. Exterior Parking Signs
 - 2. Exterior Traffic Control Signs.

1.3 QUALITY ASSURANCE

- A. Uniformity of Manufacturer: For each sign form and graphic image process indicated, furnish products of a single manufacturer.
- B. All signage to comply with A.D.A. requirements.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.
- B. Samples: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacture and design of each sign component, including graphics.
 - 1. Submit full-size sample units, if requested by Architect. Acceptable units may be installed as part of the work.
- C. Shop Drawings: Submit shop drawings for fabrications and erection of specialty signs. Include plans, elevations and large scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Andco Industries Corp.
- B. A.C. Davenport & Son Co.
- C. A.S.I. Sign Systems
- D. Spanjer Brothers, Inc.

- E. The Supersine Company
- F. Southwell Company

2.2 GENERAL REQUIREMENTS

- A. All letters shall be Helvetica Medium; upper case.
- B. Letters shall be centered on signs.
- C. Panel backgrounds shall be colored from manufacturer's standards with matte finish.

2.3 MATERIALS

- A. Aluminum Casting: Alloy and temper recommended by aluminum producer or finisher for typed of use and finish indicated and with not less than the strength and durability properties specified in ASTM B 221 for 6063 TS

2.4 EXTERIOR PARKING SIGNS

- A. Type: Silk screened letters and symbol on 0.125" dark blue baked enamel color aluminum message panel, supported on 1-1/2" square steel post set in concrete footing.

2.5 EXTERIOR TRAFFIC CONTROL SIGNS

- A. All signs shall be in accordance with the "Manual on Uniform Traffic Control Devices for Streets and Highways". Revision Number 1 and 2, dated May, 2012 and as amended.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sign units and components at locations indicated on the drawings securely mounted with concealed theft resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with manufacturer's instructions.
- B. Install sign units level, plumb and at proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair and replace damaged units as directed by Architect.
- C. Installation of Exterior Parking and Traffic Control Signs:
 - 1. Erect sign plumb with top as indicated on the drawings.
 - 2. Anchor to concrete footing with concealed anchors in accordance with manufacturer's recommendations.

3.2 CLEANING AND PROTECTION

- A. At completion of installation, clean soiled sign surface in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

END OF SECTION 101453

SECTION 102113 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Compact Laminate (CL/Solid Phenolic), Moisture Resistant Substrate: (Bobrick DuraLineSeries).
 - 1. Toilet partitions.
 - 2. Urinal privacy screens.

1.2 RELATED SECTIONS

- A. Section 055000 - Metal Fabrications.
- B. Section 061053 – Miscellaneous Rough Carpentry.
- C. Section 095100 – Suspended Acoustical Ceilings.

1.3 SUBMITTALS

- A. 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.
- B. Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:
 - 1. Plans, elevations, details of construction and attachment to adjacent construction.
 - 2. Show anchorage locations and accessory items.
 - 3. Verify dimensions with field measurements prior to final production of toilet compartments.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10-year experience manufacturing similar

products.

- B. Installer Qualifications: Minimum 2-year experience installing similar products.
- C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirement as applicable.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.5 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.7 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 recommended limits.

1.8 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 WARRANTY

- A. Manufacturer's Warranty (DuraLineSeries): Manufacturer's standard 25-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.; North Hollywood, CA 91605-6213; Tel: 818-764-1000; Fax: 818-765-2700; Email: info@bobrick.com; Web: www.bobrick.com
- B. Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.
 - 1. Acceptable Manufacturer: Scranton Products (Hiny Hiders Solid Plastic)
- C. Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the Contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

2.2 COMPACT LAMINATE (SOLID PHENOLIC), MOISTURE RESISTANT SUBSTRATE (DuraLineSeries)

- A. Compact Laminate (Solid Phenolic) Toilet Partitions: Bobrick DuraLineSeries.
 - 1. Design Type:
 - a. Standard Height.
 - 1) Door/Panel Height: 58 inches.
 - 2) Floor Clearance: 12 inches.
 - 2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches from the edge to allow for 0.175-inch overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.
 - 3. Mounting Configuration:
 - a. Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065-inch-thick with anti-grip profile.
 - 1) Stile Maximum Height: 83 inches.
- B. Compact Laminate (Solid Phenolic) Urinal Screens: Bobrick DuraLineSeries.
 - 1. Mounting Configuration:
 - a. Floor-to-ceiling.
 - 1) Screen Height: 58 inches with floor clearance: 12 inches.
 - 2) Stile Height: As required up to 10 feet 0 inches maximum.
 - b. Wall-hung.
 - 1) Screen Height: 48 inches with 12 inches floor clearance.

- C. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.
- D. Edges: Black; brown edges not acceptable.
- E. Color:
 - 1. Custom color as selected by Architect. Reference Finish Specifications.
- F. Fire Resistance:
 - 1. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B / Uniform Building Code: Class II.
 - a. Flame Spread Index (ASTM E 84): 30 for panels and stiles.
 - b. Smoke Developed Index (ASTM E 84): 55 for panels, 20 for stiles.
- G. Finished Thickness:
 - 1. Stiles and Doors: 3/4 inch.
 - 2. Panels and Screens: 1/2 inch.
- H. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
 - 1. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8-inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - 2. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4-inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1-inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- I. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16-gauge stainless steel with satin finish; 1-inch x 1-1/2 inches x 58 inches high.
- J. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.
- K. Hardware:
 - 1. Compliance: Operating force of less than 5 lb.
 - 2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - 3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - 4. Doorstops: Prevents in swinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 - 5. Fastening: Hardware is secured to door and stile with pin-in-head Torx stainless steel machine screws. Hinges, latch and optional door stops secured to door with

pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners for hinges, latch and optional door stops secured directly into core not acceptable.

- a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.
6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
7. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16-gauge (1.6 mm) sliding door latch, 14-gauge (2 mm) keeper.
8. Locking: Door locked from inside by sliding door latch into keeper.
9. Hinge Type:
 - a. Full-Height Institutional Hinge.
 - 1) Hinges: 16-gauge stainless steel, self-closing, continuous piano hinge.
10. Mounting Brackets:
 - a. Standard concealed.
 - 1) Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.
 - b. Full-Height.
 - 1) Mounting Brackets: 18-gauge stainless steel and extend full height of panel.
 - 2) U-Channels: Secure panels to stiles.
 - 3) Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 PRODUCTS

3.1 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
- C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of

installation constitutes acceptance of conditions.

3.2 INSTALLATION

- A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 - 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Use fasteners and anchors suitable for substrate and project conditions
 - 4. Install units rigid, straight, plumb, and level.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- B. Touch-up, repair or replace damaged products.
- C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 102113

SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each wall and door protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of corner guard indicated.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Certificates: For each impact-resistant plastic material, from manufacturer.
- C. Material Test Reports: For each impact-resistant plastic material.
- D. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot-long units.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 "Quality Requirements."
- D. Surface-Burning 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 qualified testing agency.
- E. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

2. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall and door protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of wall and door protection units that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.
 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 3. Self-extinguishing when tested according to ASTM D 635.
 4. Flame-Spread Index: 25 or less.
 5. Smoke-Developed Index: 450 or less.
- B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened.

2.2 CORNER GUARDS

- A. Surface-Mounted, Resilient, Plastic 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. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc.; SSM-20, or comparable product by one of the following:
 - a. Balco, Inc.
 - b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - c. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - d. Pawling Corporation.
 - 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles as follows.
 - a. Profile: Nominal 2-inch-long leg and 1/4-inch corner radius.
 - b. Height: 4 feet.
 - c. Color and Texture: As selected by Architect from manufacturer's full range.
 - 3. Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
 - 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 FABRICATION

- A. Fabricate wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Install wall protection units level, plumb, and true to line without distortions, in accordance with manufacturer's installation instructions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install wall protection units in all outside gypsum board wall corners in corridors.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

END OF SECTION 102600

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SECTION 102700 – ACCESS FLOORING

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. Access-flooring panels
 - 2. Understructure
 - 3. Floor panel coverings
- B. Related Requirements:
 - 1. Division 26 Section “Grounding and Bonding for Electrical Systems” for connection to ground of access-flooring understructure.

1.3 COORDINATION

- A. Coordinate location of mechanical and electrical work in underfloor cavity to prevent interferences with access-flooring pedestals.
- B. Mark pedestal locations on subfloor using a grid to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals.

1.4 PREINSTALLTION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.
 - 1. Review connection with mechanical and electrical systems.
 - 2. Review requirements related to sealing the plenum.
 - 3. Review procedures for keeping underfloor space clean.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include layout of access-flooring system and relationship to adjoining Work based on field-verified dimensions.
 - 1. Details and sections with descriptive notes indicating materials, finishes,

fasteners, typical and special edge conditions, accessories, and understructures.

C. Samples:

1. Floor Covering: Full-size units for each color and texture specified.
2. Exposed Metal Accessories: Approximately 10 inches in length.
3. One complete full-size floor panel, pedestal, and understructure unit for each type of access-flooring system required.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of access-flooring system.
- C. Product Test Reports: For each type of flooring material and exposed finish, for tests performed by a qualified testing agency.
- D. Preconstruction Test Reports: For preconstruction adhesives field test.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Furnish quantity of standard field panels and understructure components to support them equal to 3 percent of the amount installed and 5 percent of floor accessories.

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install access flooring until spaces are enclosed, subfloor has been sealed, ambient temperature is between 50 and 90 deg F and relative humidity is not less than 20 or not more than 70 percent.

PART 2 – PRODUCTS

1.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide access-flooring systems capable of complying with the following performance requirements according to testing procedures in CISCA's "Recommended Test Procedures for Access Floors":
 1. Concentrated Loads: 1250 lbf with the following deflection and permanent set:
 - a. Top-Surface Deflection: 0.10 inch.

- b. Permanent Set: 0.010 inch.
 - 2. Ultimate Loads: 3750 lbf.
 - 3. Rolling Loads: With local or overall deformation not to exceed 0.040 inch.
 - a. CISC Wheel 1: 10 passes at:
 - 1.) By Gravity: 1125 lbf.
 - 2.) By Bolted Stringer: 1000 lbf.
 - b. CISC Wheel 2: 10,000 passes at:
 - 1.) By Gravity: 875 lbf.
 - 2.) By Bolted Stringer: 800 lbf.
 - 4. Stringer Load Test: 450 lbf at center of span with a permanent set not to exceed 0.010 inch.
 - 5. Pedestal Axial Load Test: 5000 lbf.
 - 6. Pedestal Overturning Moment Test: 1000 lbf x inches.
 - 7. Uniform Load Test: 400 lbf/sq. ft. with a maximum top-surface deflection not to exceed 0.040 inch and a permanent set not to exceed 0.010 inch.
 - 8. Drop Impact Load Test: 150 lb.
- B. Fire Performance
 - 1. Surface-Brining Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less
 - b. Smoke-Developed Index: 50 or less
 - 2. Combustion Characteristics: ASTM E 136.

1.2 MANUFACTURERS

- A. Source Limitations: Obtain access –flooring system from single source from single manufacturer.

1.3 FLOOR PANELS

- A. Floor Panels, General: Provide modular panels interchangeable with other field panels without disturbing adjacent panels or understructure.
 - 1. Size: Nominal 24 by 24 inches.
 - 2. Attachment to Understructure:
 - a. Bolted at equipment rooms and where indicated;
 - b. BY gravity at open offices and where indicated.
- B. Cementitious-Core Steel Panels: Fabricated from cold-rolled steel sheet, with the die-cut flat top sheet and die-formed and stiffened bottom pan welded together, and with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.

1. Basis-of-Design Products: Subject to compliance with requirements, provide Tate Access Floors, Inc., ConCore 1250 PosiLock System and ConCore 1250 Bolted Stringer System or comparable product by one of the following:
 - a. ASM Modular Systems, Inc.
 - b. Bergvik North America, Inc.
 - c. Camino Modular Systems, Inc.
 - d. Computer Environments, Inc.
 - e. Haworth, Inc.

2.4 UNDERSTRUCTURE

- A. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap): made of steel.
 1. Base: Square or circular base with not less than 16 sq. in. of bearing area.
 2. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
 3. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
 4. Head: Designed to support the panel system indicated.
 - a. Provide sound-deadening pads or gaskets at contact points between heads and panels for non-bolted floors.
 - b. Bolted Assemblies: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals for bolted floor.
- B. Stringer Systems: Modular steel stringer systems designed to bolt to pedestal heads and form a grid pattern. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.
 1. Continuous Gaskets: At contact surfaces between panel and stringers to deaden sound, seal off the underfloor cavity from above, and maintain panel alignment and position.

2.5 FLOOR PANEL COVERINGS

- A. FloorScore Compliance: Floor panel coverings shall comply with requirements of FloorScore Standard.
- B. Static-Dissipative Rubber Tile: Factory applied, ASTM F 1344.
 1. Thickness: as shown on drawings.
 2. Size: as shown on drawings.
 3. Colors and patterns: as selected by Architect from full range of manufacturer's standard colors.

C. Static-Dissipative Performance Requirements:

1. Electrical Resistance: Average no less than 1 megohm and no more than 1000 megohms when installed floor coverings are surface-to-ground tested according to ASTM F 150 with 100- V applied voltage.
2. Static Generation: less than 25 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
3. Static Decay: 5000 to 0 V in less than .25 seconds when tested per FED-STD-101C/4046.1.
4. Finish the surface of floor panels with floor covering material as indicated on the contract drawings. All areas to be furnished with laminated floor panels must be maintained at ambient temperature between 50⁰ to 90⁰ F and at humidity level between 20% to 80% relative.

2.6 FABRICATION

A. Fabrication Tolerances:

1. Size: Plus or minus 0.020 inch of required size.
2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.

B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.

C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.

1. Captive Fasteners: Provide fasteners held captive to panels.

D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.

1. Number, Size, Shape, and Location: As indicated.
2. Grommets: Where indicated, fit cutouts with manufacturer's standard grommets; or, if size of cutouts exceed maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding with tapered top flange. Furnish removable covers for grommets.
3. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.7 ACCESSORIES

A. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.

1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Service Outlets: Standard UL-listed and –labeled assemblies, for recessed mounting flush with top of floor panels; for power, communication, and signal services; and complying with the following requirements:
 1. Structural Performance: Cover capable of supporting a 1000-lbf concentrated load.
 2. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.
 3. Location: In center of panel quadrant unless otherwise indicated.
 4. Receptacles and Wiring: Electrical receptacles and wiring for service outlets are specified elsewhere.
- C. Floor Grilles: Standard load-bearing grilles formed from aluminum to produce movable one-piece unit precisely fitted in factory-prepared openings of standard field panels, with adjustable/removable dampers and complying with the following requirements:
 1. Air-Distribution Characteristics: 2096 cfm at 0.10-inch wg static pressure.
 2. Open Area: 56 percent open area.
 3. Structural Performance: Capable of supporting a 1000-lbf concentrated load.
 4. Fire-Test-Response Characteristics: Classified 94V-0 according to UL 94.
 5. Basis of Design Product: “Tate Access Floors Inc., GrateAire – 24” or comparable product by the following manufacturers:
 - a. ASM, Accel-Air-Grate AF500
 - b. Triad, Chamfer ICE Airflow
- D. Plenum-Wall Brush Grommets: Self-sealing cable brush grommet with minimum 4-by-13-inch rectangular usable area for passage of power and signal cables through plenum walls. Frame of ABS plastic with passageway consists of intermediate layer of flexible EPDM rubber and interwoven nylon filaments.
- E. Cavity Dividers: Provide manufacturer’s standard metal dividers located where indicated to divide underfloor cavities.
- F. Closures: Where underfloor cavity is not enclosed by abutting walls or other construction, provide metal-closure plates with manufacturer’s standard finish.
- G. Panel Lifting Device: Panel manufacturer’s standard portable lifting device for each type of panel required.
- H. Perimeter Support: Where indicated, provide manufacturer’s standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, foreign deposits, and debris that might interfere with attachment of pedestals.
 - 2. Verify that concrete floor sealer and finish have been applied and cured.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches.
- B. Locate each pedestal, complete any necessary subfloor preparation and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.3 INSTALLATION

- A. Install access-flooring system and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.
- B. Adhesive Attachment of Pedestals: Set pedestals in adhesive, according to access-flooring manufacturer's written instructions, to provide full bearing of pedestal base on subfloor.
- C. Mechanical Attachment of Pedestals: Attach pedestals to subfloor with post-installed mechanical anchors.
- D. Adjust pedestal to permit top installed panels to be set flat, level, and to proper height.
- E. Stringer Systems: Secure stringers to pedestal heads according to access-flooring manufacturer's written instructions.
- F. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.
- G. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch (3 mm) where panels abut vertical surfaces.
 - 1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core

panels with sealer recommended in writing by panel manufacturer.

- H. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under already-installed access flooring.
- I. Grounded Flooring Access Panel Systems: Ground flooring system as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
 - 1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.
- J. Underfloor Dividers: Scribe and install underfloor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.
- K. Closures: Scribe closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within underfloor cavity.
- L. Clean, dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.
- M. Seal underfloor air cavities at construction seams, penetrations, and perimeter at access flooring, according to manufacturer's written instructions.
- N. Seal all construction seams, penetrations, and perimeter at access flooring, according to manufacturer's written instructions.
- O. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
 - 1. Plus or minus 1/16 inch in any 10-foot distance.
 - 2. Plus or minus 1/8 inch from a level plane over entire access-flooring area.

3.4 PROTECTION

- A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesives to set.
- B. After completing installation, vacuum access flooring and cover with continuous sheets of reinforced paper or plastic. Maintain protective covering until time of Substantial Completion.
- C. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 102700

SECTION 102800 - TOILET AND BATH ACCESSORIES

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. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Underlavatory guards.
 - 4. Electric Hand Dryers

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements.
 - 3. Material and finish descriptions.
 - 4. Manufacturer's warranty.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- C. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 TOILET AND BATH ACCESSORIES

- A. Refer to Toilet Accessories Schedule on Drawings for manufacturers, products, and finishes.

2.3 UNDERLAVATORY GUARDS

- 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. IPS Corporation; Truebro® Lav Guard 2 Series.
 - 2. Plumberex Specialty Products, Inc.; Pro-Extreme.
- B. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 HIGH-SPEED HAND DRYERS

- A. Subject to compliance with requirements, provide hand dryers by Bobrick, or approved equal.
 1. Acceptable Manufacturers:
 - a. World Dryer (Slimdri #L-973A)
 - b. Saniflow Corporation (Speedflow Plus #M17ACS-UL)
- B. Automatic Hand Dryer – Surface Mounted
 1. Basis of Design Product: B-7128
 2. Mounting: Surface Mounted
 3. Operation: Automatic, microprocessor controlled infrared-sensor activated with timed power cut-off switch.
 - a. Maximum Operation Time: 17 seconds.
 4. Cover Material and Finish: Stainless steel type 304 with no. 4 brushed finish
 5. Electrical Requirements: Universal Voltage automatically configures the dryer to operate on 110-120V
 6. Sound Level: 71 dB

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' 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.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104313 – DEFIBRILLATOR CABINETS

PART 1 – GENERAL

1.1 SUMMARY

- A. Defibrillator cabinets, accessories and their installation.

1.2 RELATED SECTIONS

- A. Section 014200 - Reference Standards and Definitions.

1.3 REFERENCES

- A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA):
 - 1. ANSI/NFPA 10 Portable Fire Extinguishers.
- B. Underwriters Laboratories of Canada (ULC):
 - 1. CAN/ULC S508 Standard for the Rating and Fire Testing of Fire Extinguishers.
- C. American Heart Association (AHA):
 - 1. 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Section 013300 - Submittal Procedures.
- B. Shop Drawings: Submit drawings showing exterior and interior dimensions, defibrillator mounting, corner sections, hinge arrangement and hardware.
- C. Product Data: Submit product data, including manufacturer's SPEC-DATA® product sheet, for specified products.
 - 1. Material safety data sheets.
- D. Quality Assurance:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
3. Manufacturer's Instructions: Manufacturer's installation instructions.
- E. Manufacturer's Field Reports: Manufacturer's field reports specified.
- F. Closeout Submittals:
 1. Warranty: Submit warranty documents specified.
 2. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Section 017700 - Closeout Procedures.
 - a. Include: Manufacturer's instructions covering maintenance requirements and parts catalog, giving complete list of repair and replacement parts with cuts and identifying numbers.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.
- B. Regulatory Requirements.
 1. Defibrillator cabinets must meet the requirements of building codes and zoning bylaws issued by federal, state and local government authorities having jurisdiction.
- C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 013110 - Project Meetings.

1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with 01 61 00 – Basic Product Requirements.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery:

1. Deliver materials in manufacturer's original packaging with identification labels intact.

D. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

E. Waste Management and Disposal:

1. Separate waste materials for Reuse and Recycling in accordance with Section 01 74 10 - Construction Waste Management and Disposal.

1.7 PROJECT AMBIENT CONDITIONS

- A. Installation Location: Assemble and erect components only when temperatures are above 40 degrees F.

1.8 SEQUENCING

- A. Sequence With Other Work: Comply with defibrillator cabinet manufacturer's written recommendations for sequencing construction operations.

1.9 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.10 MAINTENANCE

- A. Include complete maintenance on defibrillator cabinets for 12 months after date of acceptance by Owner.
- B. Regularly and systematically Monthly examine, clean, adjust cabinets.
- C. Use only standard parts from product line of equipment manufacturer.
- D. Perform work during regular trade working hours satisfactory to Owner.
- E. Ensure that maintenance personnel register with designated building personnel at time of inspections and maintenance.

1.11 EXTRA MATERIALS

- A. Provide maintenance materials in accordance with Section 017700 - Closeout Submittals.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

2.2 PRODUCTS/SYSTEMS

- A. Manufacturer: JL Industries, Inc. or approved equal.
 - 1. Contact: 4450 W 78th St. Cir., Bloomington, MN 55435

2.3 AUTOMATIC EXTERNAL DEFIBRILLATOR (AED) CABINETS

- A. Style: Interior, Semi-Recessed, 1- hour fire-rated walls.
- B. Cabinet Material:
 - 1. Steel with electrostatic White impact resistant powder coat finish.
- C. Door Style: [Solid] [Full acrylic] with [Vandal resistant] handle, [Lock] and concealed hinges. Specifier Note: For ADA code applications, choose cabinets with trim of either 1.5 or 3 inches (38 or 76 mm).
- D. Trim Style: Trimless.
 - 1. Frame and Door: 1.75 inches.
- E. Tub: Aluminum mill finish.
- F. Acceptable Materials: JL Industries, Inc., Lifestart 1400 Series With FIRE-FX.

2.4 ACCESSORIES

- A. Vandal Resistant Handle: Cam style locking device.
 - 1. Acceptable Material: JL Industries, Inc., SAF-T-LOK.
- B. Cabinet Seal:
 - 1. Acceptable Material: JL Industries, Inc., SAF-T-CLASP.
- C. Alarm: Ensure 85 dB horn sounds for 2 minutes minimum when door is opened

and stops when door closes and with flashing strobe light.

1. Keyed Alarm: On/Off.
2. Horn Power: 9 Volt DC battery With low power indicator.
3. Acceptable Material: JL Industries, Inc., model Commander Alarm.

D. Defibrillator:

1. Acceptable Material: Medtronic ERS, Model Lifepak CR Plus.

2.5 IDENTIFICATION

- A. Identify defibrillator cabinets in accordance with ANSI/NFPA 10 using Silk screen print on inside of acrylic.

1. Acceptable Material: JL Industries, Inc., Defibrillator Cabinet Identification.

2.6 SOURCE QUALITY CONTROL

- A. Ensure defibrillator cabinet components and materials are from single manufacturer.

2.7 PRODUCT SUBSTITUTIONS

- A. Substitutions: [In accordance with Section 016300 - Product Substitution Procedures.

PART 3 EXECUTION

3.1 INSTALLERS

- A. Provide experienced and qualified technicians to carry out erection, assembly and installation of defibrillator cabinets.

3.2 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and JL Industries, Inc., SPEC-DATA sheets.

3.3 EXAMINATION

- A. Site Verification of Conditions:

1. Verify that substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to installation of defibrillator cabinets.
2. Inform Architect of unacceptable conditions immediately upon discovery.
3. Proceed with installation only after unacceptable conditions have been remedied.

3.4 PREPARATION

- A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of defibrillator cabinet materials.

3.5 INSTALLATION

- A. Coordinate installation with the manufacturer's written installation details and instructions.

END OF SECTION 104313

SECTION 104413 - FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.7 SEQUENCING

- A. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 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. J. L. Industries, Inc.;
 - b. Larsen's Manufacturing Company;
 - c. Potter Roemer LLC;
- B. Cabinet Construction: Nonrated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.

- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. 1. FEC-1 Recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

FEC-1R Rated Recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

 - b. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- 2. FEC-2 Semi- Recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - Square-Edge Trim: 2-1/2 to 3-inch backbend depth
- 3. FEC-3 Surface mount cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - Square-Edge Trim
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Steel sheet.
- G. Door Style: Full acrylic bubble with frame.
- H. Door Glazing: Molded acrylic bubble.
 - 1. Acrylic Bubble Color: Clear transparent.
- 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 projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

- a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to location indicated on Drawings.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: As indicated.
 - 4) Orientation: As indicated on Drawings.

K. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.

2.3 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.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 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.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace 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 PERFORMANCE REQUIREMENTS

- 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.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket 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. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.

4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel 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. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105126 – PLASTIC LOCKERS

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. Solid Plastic Lockers.
- B. Related Sections:
 - 1. Division 06; Section “Rough Carpentry” for furring, blocking and other carpentry work not exposed to view.
- C. References
 - 1. UL – GREENGUARD certified low emitting materials.
 - 2. ASTM - B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. ASTM – A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include dimensioned layouts, elevations, trim, closures and accessories.
 - 2. Product Data: Manufacturer’s descriptive data
 - 3. Samples: 3 x 3 inch samples showing available colors in each color.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years of experience in manufacture of solid plastic lockers with products in satisfactory use under similar service conditions.
- B. Installer Qualifications: Minimum 5 years of experience in work of this Section. Certified installer through manufacturer’s installation certification program.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordination sizes and locations of concrete bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in an upright condition. Protect plastic lockers from exposure to direct sunlight. This product is not intended for outdoor use.

1.8 WARRANTY

- A. Provide manufacturer's 25-year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-Of-Design Product: Subject to compliance with requirements, provide Tufftec Lockers as manufactured by Scranton Products or comparable product by one of the following:
 - 1. Bradley Corporation.
 - 2. Global.
 - 3. PSISC/Columbia Lockers
- B. Materials
 - 1. High Density Polyethylene (HDPE): Polyethylene Thermoplastic formed into solid plastic components with homogeneous color throughout, with smooth orange peel finish.
 - 2. Heavy Duty Extruded Aluminum: B221, 6063-T6.
 - 3. Chromium Plated Steel: A167.
 - 4. Recycled Content: Minimum 25 percent.
 - 5. Color: To be selected from manufacturer's color range.

2.2 STANDARD PLASTIC LOCKERS

- A. Locker Configuration: Double Tier
- B. Locker Dimensions:
 - 1. Height: As shown on drawings

2. Width: As shown on drawings
3. Depth: As shown on drawings
- C. Material: High density polyethylene (HDPE) plastic, 100 percent post-consumer recycled material.
- D. Side, Tops, Bottoms, Backs, and Shelves: 3/8 inch thick HDPE plastic, grey finish.
 1. Sides: 3/8 inch thick HDPE plastic, grey finish, with horizontal side venting.
- E. Locker Tops: Flat top finished in same color as locker door.
- F. Doors and Frame: 1/2 inch thick HDPE plastic.
 1. Doors: 1/2 inch thick HDPE plastic with horizontal venting.
 2. Handle: ADA compliant ergonomic handle, injection molded plastic
 3. Locks: Diggy Locks
 4. Hinge: Heavy duty extruded aluminum with corrosion free stainless steel pin with silver finish.
 5. ADA Compliance Package: 3134 aluminum Series 1100, H18, satin matte finish ADA plaque, adjustable 3/8 inch HDPE plastic shelf with plastic clips
 6. Latch Bar: 3/8 inch thick HDPE plastic with multiple latch points, fastened with stainless steel tamper-resistant screws
 7. Venting: Lattice Mesh
- G. Assembly Profile: Full height of lockers, PVC plastic, snap fit assembled onto locker sides.
- H. Accessories.
 1. Coat hook: Two-prong, high impact plastic, black finish, mounted to bottom of shelf or divider, one per door opening.
 2. End Panels: 1/2 inch thick HDPE plastic, color and finish same as locker door
 3. Filler Panels and Trim: 1/2 inch thick HDPE plastic, color and finish same as locker door
 4. Number Plate: 3134 aluminum, Series 1100, H18, satin matte finish, fastened to locker with corrosion resistant stainless steel rivets
 5. Locker Base: 1 inch thick HDPE plastic, with color and finish same as locker door.
 6. Wall hook: Two per door opening.
 7. Shelf: provide one (1) shelf
 8. Color: As selected by Architect from manufacturer's color range.

2.3 FABRICATION

- A. Fabricate locker components square and rigid; finish free from scratches and chips.
- B. Fabricate locker components for snap-together assembly or slide-together dovetail connections providing solid and secure, anti-racking construction.
- C. Fabricate adjacent lockers with common side panel.

- D. Fabricate locker units for assembly in maximum of three adjacent lockers.
- E. Fabricate locker benches to sizes indicated in single lengths

PART 1 - EXECUTION

1.1 INSTALLATION

- A. Install lockers in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set lockers on prepared locker base.
- C. Set plumb, level, rigid, and aligned.
- D. Attach lockers to supporting construction with anchors best suited to substrate conditions.
- E. Attach locker benches to floor.

3.2 ADJUSTING

- A. Adjust doors and latches to operate correctly.

pEND OF SECTION 105126

SECTION 107516 - GROUND-SET FLAGPOLES

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 one ground-set flagpole made from aluminum.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Delegated-Design Submittal: For flagpoles.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.
- B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 100 mph.

2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
 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. Acme/Lingo Flagpoles LLC.
 - b. American Flagpole; a Kearney-National Inc. company.
 - c. Baartol Company.
 - d. Concord Industries, Inc.
 - e. Eder Flag Manufacturing Company, Inc.
 - f. Ewing Flagpoles.
 - g. Morgan-Francis Flagpoles and Accessories.
 - h. U.S. Flag & Flagpole Supply, LP.
- B. Exposed Height: 40 feet, refer to drawings for additional information.
- C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 1. Stainless steel.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
 1. Halyard Flag Snaps: Stainless-steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

- A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

- B. Sand: ASTM C 33/C 33M, fine aggregate.
- C. Elastomeric Joint Sealant: Joint sealant complying with requirements in Section 079200 "Joint Sealants."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

2.7 FLAG POLE LIGHT

- A. MFG: Earth tech Products
 - 1. Product Name: High End Commercial Solar Flagpole Light.
 - 2. Product Type: Solar flagpole light
 - 3. Product code: HECSFPL-12
 - 4. Battery Capacity: High Capacity 3.7 Volt 12,000 mAh battery
 - 5. Battery Type: NiMH
 - 6. LEDs: 12 ultra-bright 10mm LEDs
 - 7. Solar Panel: 6 volt 15 Watt
 - 8. Run Time: 7-8 hour solar charge will provide 12 hours of shine time at night
 - 9. Manufacturer warranty: 1 year.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

- C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107516

SECTION 108213 - EQUIPMENT SCREENS

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. Fixed, extruded-aluminum louvered roof top equipment screens

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For equipment screens and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: For each type of metal finish required.
- D. Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

2. Wind Loads: Determine loads based on a uniform pressure of 20 lb./sq. ft., acting inward or outward.

2.2 EXTRUDED-ALUMINUM ROOF TOP EQUIPMENT SCREEN

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following or approved equal:
 1. Ruskin Company; Model EV811 Horizontal Screen
 2. Architectural Louvers: <http://www.archlouvers.com> - phone: 888-568-8371 - Model V2TH
Industrial Louvers Inc. (ILI) - Contact: 511 South 7th Street, Delano, MN 55328; Telephone: (763) 972-2981; Fax: (763) 972-2911. - Model: 450XPI
- B. Blades:p
 1. Style: Horizontal.
 2. Material: Extruded aluminum, Alloy 6063-T5.
 3. Wall Thickness: 0.081 inch, nominal.
 4. Angle: 45 degrees.
 5. Centers: 5 inches, nominal.
- C. Fasteners: Aluminum or stainless steel concealed anchorage, not visible on exterior face of screen.
- D. Supports: Aluminum, as required for wind load.
- E. Performance Data:
 1. Based on testing 48 inch by 48 inch size unit in accordance with AMCA 500.
 2. Free Area: 44 percent, nominal.
 3. Free Area Size: 7.10 square feet.

2.3 ACCESSORIES

- A. Corners: As indicated.
- B. Access Sections: Hinged.
- C. Necessary framing attachment clips and fasteners to attach to the structural steel framing.

2.4 FABRICATION, GENERAL

- A. Join concealed frame members to each other and to fixed louver blades with fillet welds concealed from view welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.5 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect areas to receive screens. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the screens. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install screens at locations indicated on the drawings and in accordance with manufacturer's instructions.
- B. Locate and place equipment screens level, plumb, and at indicated alignment with adjacent work.
- C. Provide perimeter reveals and openings of uniform width to allow for thermal expansion, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

END OF SECTION 108213

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SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers.
 - 2. Motor-operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED - MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by MechoShade Systems, Inc. or comparable product by one of the following:
 - 1. DFB Sales.
 - 2. Draper Inc.

3. Hunter Douglas Contract.
4. Lutron Electronics Co., Inc.
5. OEM Shades Inc.
6. Shade Techniques, LLC.
7. Silent Gliss USA, Inc.

- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: As indicated on Drawings.
 - b. Limit Stops: Provide upper and lower ball stops.

- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings.
2. Direction of Shadeband Roll: Reverse, from front of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

- D. Shadebands:

1. Shadeband Material: As selected by Architect.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.

- E. Installation Accessories:

1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
2. Endcap Covers: To cover exposed endcaps.

2.3 MOTOR-OPERATED - MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc.; ElectroShade Systems for motorized shades, or comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. Lutron Electronics Co., Inc.
 - 4. Nysan Solar Control Inc.
 - 5. OEM Shades Inc.
 - 6. Shade Techniques, LLC.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.4 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: Single phase, 110 V, 60 Hz.
 - 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for flush mounting. Provide the following for remote-control activation of shades:
 - a. Control Station: Momentary-contact, three-position, switch-operated control station with open, close, and off functions.
 - 4. Limit Switches: Provide programming of upper and lower stopping points (operating limits) of shadebands into motors via a hand held removable program module/configurator.
 - 5. Operating Features:
 - a. Capable of interface with audiovisual control system.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required for accommodating operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: As indicated on Drawings.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.

3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Shadebands:
 1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- E. Installation Accessories:
 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
 - c. Endcap Covers: To cover exposed endcaps.
 - d. Installation Accessories Color and Finish: As selected from manufacturers' full range.
 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.5 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: 3% light filtering woven fabric, stain and fade resistant, type selected by Architect.
- C. Light-Blocking Fabric: 1% light blocking opaque fabric, stain and fade resistant, type selected by Architect.

2.6 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 2. Installation Locations: As indicated on Drawings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass unless indicated otherwise. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:

1. Main Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
2. Main Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
3. Roller shade installer/dealer shall run line voltage (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction
5. Main Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

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SECTION 123216 - MANUFACTURED PLASTIC-LAMINATE-FACED CASEWORK

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 plastic-laminate-faced cabinets and countertops.

1.3 DEFINITIONS

- A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.
- C. Samples: For cabinet finishes.
- D. Samples for Initial Selection: For cabinet finishes.
 - 1. Samples for Verification: 8-by-10-inch Samples for each type of finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project and who is a certified participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework 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. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - 2. Warranty Period: Five years from date of Substantial Completion.

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. Cal-Dak Cabinets.

2. CampbellRhea.
3. R. C. Smith Company.
4. Sidney Millwork Company.
5. Stevens Industries, Inc.
6. Techline USA, LLC.
7. Terrill Manufacturing Co. Inc.
8. TMI Systems Design Corporation.

- B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

2.2 CASEWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
1. Grade: Custom.
 2. Provide labels and certificates from AWI certification program indicating that casework, including installation, complies with requirements of grades specified.
- B. Product Designations: Drawings indicate configurations of manufactured plastic-laminate-faced cabinets by referencing designations of Casework Design Series numbering system in Appendix A of the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

2.3 CASEWORK

- A. Design:
1. Flush overlay.
- B. Grain Direction for Wood Grain Plastic Laminate:
1. Vertical on both doors and drawer fronts, with continuous vertical matching.
 2. Lengthwise on face frame members.
 3. Vertical on end panels.
 4. Side to side on bottoms and tops of units.
 5. Vertical on knee-space panels.
 6. Horizontal on aprons.
- C. Exposed Materials:
1. Plastic Laminate: Grade VGS.
 - a. Colors and Patterns: As selected by Architect from manufacturer's full range.
 2. Unless otherwise indicated, provide specified edge banding on all exposed edges.
 3. Solid Wood: Clear hardwood lumber of species indicated, selected for compatible grain and color.

4. Wood Species: As selected by Architect.

D. Semiexposed Materials:

1. Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.
 - a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
2. Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E. Concealed Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood.
3. Plastic Laminate: Grade BKL.
4. Particleboard.
5. MDF.

2.4 MATERIALS

- A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.
- C. Softwood Plywood: DOC PS 1.
- D. Particleboard: ANSI A208.1, Grade M-2.
- E. MDF: ANSI A208.2, Grade 130.
- F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 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. ABET Inc.
 - b. Arborite; a division of ITW Canada.
 - c. Formica Corporation.
 - d. Lamin-Art, Inc.
 - e. Panolam Industries International Inc.
 - f. Wilsonart International.

- G. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.

2.5 COLORS AND FINISHES

- A. Wood Colors and Finishes: As selected by Architect from casework manufacturer's full range.
- B. Plastic-Laminate Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.
- C. PVC Edgebanding Color: As selected from casework manufacturer's full range.

2.6 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
 - 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
- B. Butt Hinges: Stainless-steel, **fully concealed**, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high and provide three hinges for doors more than 48 inches high. 270-degree door swing.
- C. Pulls: Solid stainless-steel wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel flush pulls. Provide two pulls for drawers more than 24 inches wide.
- D. Door Catches: Dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.
- E. Drawer Slides: BHMA A156.9, Type B05091.
 - 1. Heavy Duty (Grade 1HD-100): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.
- F. Drawer and Hinged Door Locks: Type as selected, five-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
 - 1. Provide a minimum of two keys per lock and six master keys.
 - 2. Provide door locks for all casework.
- G. Adjustable Shelf Supports: Mortise-type, powder-coated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 CASEWORK INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install casework level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
- E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123216

SECTION 123600 - MISCELLANEOUS COUNTERTOPS

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 the following:
 - 1. Quartz agglomerate countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Including material characteristics, performance properties, fabrication information, installation instructions and maintenance instructions.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures faucets and other items countertops.
 - 2. Show seam locations.
- C. Samples for Verification: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: Mold Resistance Certification for quartz countertops.
- C. Evaluation Reports: For surface burning characteristics.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by Wilsonart or comparable product by an approved manufacturer.
- B. Material: 2 cm quartz surface countertop.
- C. Performance:
 - 1. Moisture Absorption: typical results negligible; ASTM C97
 - 2. Modulus of Rupture: typical results 6,800 psi; ASTM C99
 - 3. Compressive Strength: typical results 24,750 psi; ASTM C170
 - 4. Abrasion Resistance: typical results 223; ASTM C501
 - 5. Bond Strength: typical results 205; ASTM C482
 - 6. Thermal Shock: Passes 5 cycles: ASTM 484
 - 7. Coefficient of Thermal Expansion: typical results 1.2×10^{-5} inch/°F; ASTM C531
 - 8. Breaking Strength of Tile: typical results 3,661 lbf; ASTM C648
 - 9. Resistance to Freeze-Thaw Cycling: Unaffected 15 cycles; ASTM C1026
 - 10. Dynamic Coefficient of Friction: 0.72 dry / 0.34 wet; ANSI A137.1

11. Surface Burning Characteristics: typical results 17 (Class A/1 Rating); ASTM E84
 12. Smoke Density: Flaming 196, Non-flaming 69; ASTM E662
 13. Stain Resistance: Unaffected; ANSI Z124.6
- D. Edge Profile: Ridgeline Edge
- E. Finish/Color: Refer to Finish Schedule on Drawings.
- F. At open counter areas without base cabinet support, provide substrate as recommended by manufacturer for application and conditions of use.
- G. Surface Adhesive: Epoxy or polyester adhesive of a type recommended by the manufacturer for application and conditions of use.
1. Adhesive which will be visible in finished work shall be tinted to match quartz surface.
- H. Joint Sealant:
1. Clear sealant of type recommended by manufacturer for application and use.
 2. Provide anti-bacterial type in toilet, bath, food preparation,
 3. Acceptable manufacturers:
 - a. Dow Corning.
 - b. GE Sealants
- I. Solvent: Denatured alcohol for cleaning Cambria surfacing to assure adhesion of adhesives and sealants.
- J. Cleaning Agents: Mild soap and water.
- K. Fabrication: Refer to manufacturer's fabrication requirements.

2.2 ACCESSORIES

- A. Grommets for cable passage through countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage. Color as selected by Architect.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.4 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.
- C. Verify dimensions by field measurements prior to installation.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare

edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 120 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 120 inch sag, bow, or other variation from a straight line.
 - 2. If not integral part of top; secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- H. Protect finished surfaces from scratches. Apply masking where necessary. Take necessary precautions to prevent dirt, grit, dust and debris from other trades from contacting the surface by covering the top and exposed edge profiles after installation is completed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123600

SECTION 123623 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

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 plastic-laminate countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including high-pressure decorative laminate, adhesive for bonding plastic laminate and fire-retardant-treated materials.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures faucets and other items installed in plastic-laminate countertops.
 - 2. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For the following:

1. High-pressure decorative laminate.
2. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 degrees F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction.
 - 1. Provide labels from AWI certification program indicating that countertops, comply with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Panolam Industries International, Inc.
 - d. Wilsonart International; Div. of Premark International, Inc.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range in the following categories:
- E. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- F. Core Material: Exterior-grade plywood.
- G. Core Material at Sinks: Exterior-grade plywood.
- H. Core Thickness: 3/4 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
- J. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

2.4 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.5 MISCELLANEOUS MATERIALS

- A. Adhesives: Do not use adhesives that contain urea formaldehyde.
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.

- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. If not integral part of top; secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623

SECTION 123661 - SOLID SURFACE 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. Related Sections include the following:
 - 1. Division 06 Section "Miscellaneous Rough Carpentry" for Blocking.
 - 2. Division 06 Section "Interior Finish Carpentry."

1.3 DEFINITION

- A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 SUBMITTALS

- A. See Section 013300 - Administrative Requirements, for submittal procedures.
- B. Product data:
 - 1. For each type of product indicated.
 - 2. Product data for the following:
 - a. Solid surface window sills, counter tops, and accessories.
- C. Shop drawings:
 - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
 - c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.
- C. Samples:
 - 1. For each type of product indicated.
 - a. Submit minimum 6-inch by 6-inch sample in specified gloss.

- b. Cut sample and seam together for representation of inconspicuous seam.
 - c. Indicate full range of color and pattern variation.
- D. Product data:
 - 1. Indicate product description, fabrication information and compliance with specified performance requirements.
- E. Product certificates:
 - 1. For each type of product, signed by product manufacturer.
- F. Fabricator/installer qualifications:
 - 1. Provide copy of certification number.
- G. Manufacturer certificates:
 - 1. Signed by manufacturers certifying that they comply with requirements.
- H. Maintenance data:
 - 1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
 - a. Maintenance kit for finishes shall be submitted.
 - 2. Include in project closeout documents.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- B. Fabricator/installer qualifications:
 - 1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
- C. Applicable standards:
 - 1. Standards of the following, as referenced herein:
 - a. American National Standards Institute (ANSI)
 - b. American Society for Testing and Materials (ASTM)
 - c. National Electrical Manufacturers Association (NEMA)
 - d. NSF International

2. Fire test response characteristics:
 - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1) Flame Spread Index: 25 or less.
 - 2) Smoke Developed Index: 450 or less.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.7 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 1. Warranty shall provide material and labor to repair or replace defective materials.
 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- B. Manufacturer's warranty period:
 1. Ten years from date of substantial completion.

1.8 MAINTENANCE

- A. Provide maintenance requirements as specified by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 1. Subject to compliance with requirements, provide products by Corian® surfaces from the DuPont company (basis of design) or approved equivalent.

2.2 MATERIALS

- A. Solid polymer components

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
- B. Thickness:
1. 1/2 inch
- C. Edge treatment:
1. One inch (1") thick full bullnose
- D. Performance characteristics:

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5×10^{-6} psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2×10^{-6} psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale
	56	ASTM D 785 Barcol Impressor ASTM D 2583
Thermal Expansion	3.02×10^{-5} in./in./°C (1.80×10^{-5} in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact	0.28 ft.-lbs./in. of notch	ASTM D 256

(Notched Specimen)		(Method A)
Ball Impact Resistance: Sheets	No fracture—1/2 lb. ball: 1/4" slab—36" drop 1/2" slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	$\Delta E^*_{94} < 5$ in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors) (“LC50” Test)	Pittsburgh Protocol Test
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	
† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs. Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories. NEMA results based on the NEMA LD 3-2000		

2.3 ACCESSORIES

A. Joint adhesive:

1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

B. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Conductive tape:

1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

D. Insulating felt tape:

1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

E. Fasteners and accessories:

1. Stainless steel fasteners.

2.4 FACTORY FABRICATION

A. Shop assembly:

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
 - a. Reinforce with strip of solid polymer material, 2" wide.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.

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2.5 FINISHES

A. Select from the manufacturer's standard color chart.

1. Color:
 - a. To be selected from manufacturer standard color chart.

B. Finish:

1. Provide surfaces with a uniform finish.
 - a. Matte; gloss range of 5–20.
 - 1) To be selected from manufacturer standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 1. Provide product in the largest pieces available.
 - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - 4. Cut and finish component edges with clean, sharp returns.
 - 5. Rout radii and contours to template.
 - 6. Anchor securely to base cabinets or other supports.
 - 7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

3.3 REPAIR

- A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.4 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Remove adhesives, sealants and other stains.

END OF SECTION 123661

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SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

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. Roll-up rail mats.
 - 2. Recessed frames.

1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Shop Drawings:
 - 1. Divisions between mat sections.
 - 2. Perimeter floor moldings.
- C. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: Assembled sections of floor mat.
 - 2. Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform floor load of 300 lbf/sq. ft.
 - 2. Wheel load of 350 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 ROLL-UP RAIL MATS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Group; Pedimat, or a comparable product by one of the following:
 - 1. Arden Architectural Specialties, Inc.
 - 2. Balco, Inc.
 - 3. J. L. Industries, Inc.
 - 4. Musson Rubber Company.
 - 5. Pawling Corporation; Architectural Products Division.
 - 6. Reese Enterprises, Inc.
- B. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 11/16 inch thick, sitting on continuous vinyl cushions.
 - 1. Tread Inserts: Mineral abrasive.
 - 2. Colors of Inserts: As selected by Architect from full range of industry colors.
 - 3. Rail Color: Clear.
 - 4. Hinges: Plastic.
 - 5. Mat Size: As indicated.

2.3 FRAMES

- A. Recessed Frames: Manufacturer's standard extrusion.
 - 1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - a. Color: Clear.

2.4 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.5 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 13 85 00 – BACNET BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 BACNET BUILDING AUTOMATION SYSTEM (DIRECT-DIGITAL CONTROL (DDC) SYSTEM) DESCRIPTION

- A. The Controls Contractor shall supply and install a complete Direct Digital Control (DDC) Building Automation System (BAS) as required to accomplish the Sequences of Control for heating, ventilating, air-conditioning and other building-level equipment and systems as described herein. The intent is to utilize BACnet compliant equipment and interface it with a JENEsys Edge 534-AX controller with BACnet Niagara driver and utilize a local PC as a monitor over the internet.

1.2 WORK INCLUDED

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operational DDC BAS pursuant with this specification and as shown on the associated contract drawings.
- B. Coordinate the existing conditions and requirements of all mechanical and electrical equipment that will be controlled by the DDC BAS.
- C. Coordinate interface requirements for integration into BAS of following building-level equipment and systems:
 - 1. Computer/Server Room Air Conditioning Unit
 - 2. VRF System
 - 3. DOAS System
 - 4. Leak detection system
- D. All labor, material, equipment and service not specifically referred to in this specification or on associated drawings that are required to fulfill the functional intent of this specification shall be provided at no additional cost to the Owner.

1.3 DDC SYSTEM REQUIREMENTS

- A. DDC Systems installed under this specification shall strictly adhere to the following characteristics:
 - 1. Building Automation System (BAS) Direct Digital Controls (DDC) shall consist of native BACnet, microprocessor-based, peer-to-peer, networked, distributed devices utilizing the BACnet communication protocol in an open, interoperable system. The BAS also includes operator interface devices LynxSpring Jenesys Edge 534-AX controller, programming, and configuration software applications,

DDC input/output devices, non-DDC automatic temperature controls, enclosures and interconnecting conduit and wire.

- a. The BACnet operating stack must be embedded directly in every Device at the board level, and in all operator interface software packages.
 - b. DDC controllers that are not BACnet compliant shall not be acceptable under this specification and are strictly prohibited.
- B. The BAS shall be modular in nature and comprised of a network of stand-alone DDC devices. The System shall be designed and implemented in such a way that it may be expanded in both capacity and functionality through the addition of DDC Devices, sensors, actuators, etc,
- C. Program database, data acquisition, and all control sequence logic shall reside in each DDC Device. The Building Level Communication Network (BLCN) shall not be dependent upon connection to a Server or Master Controller for performance of the Sequence of Control as outlined in this specification. Each individual Device shall, to the greatest possible extent, perform its programmed sequence without reliance on the BLCN.
- D. BAS shall be provided with a complete Web enabled operator interface. The Web enabled application shall operate on industry standard PC hardware. Proprietary server hardware or "Black Boxes" will not be acceptable. Third party Web enabled applications are acceptable if they are configured to be indistinguishable from the OWS applications.
- E. The Owner at the Owner's expense shall provide connection to the Internet for the BAS. The LAN connection type and configuration (TCP/IP addressing scheme, etc.) will be information provided to the System Contractor from the Owner, or Owner's representative.
- F. All BAS DDC Devices at all levels shall be fully custom-programmable in the field using the standard Operators Workstation Software. No configurable, canned program application specific controllers will be permitted.
- G. All BAS DDC Devices shall be capable of updating firmware using software via internet without replacing any hardware, microprocessors, or chips.
- H. The BAS shall be capable of sending system alarms and Event Notifications to pagers, and email services.
- I. Actuation of control devices shall be electronic. Spring return fail-safe actuation shall be provided when loss of property and/or property damage is possible and where specified.
- J. All binary output points shall be protected from short cycling via output configuration and/or programming. This feature shall allow minimum on time and off-time to be configurable.

1.4 BASIC 2SYSTEM ARCHITECTURE

- A. The DDC BAS as provided and installed under this specification shall be a complete system from a single manufacturer designed for use on intranets and the internet.
- B. The primary BAS components shall include but not be limited to:
 - 1. Operator Workstation Software (B-OWS)
 - 2. Building Controllers (B-BC)
- C. Enterprise Level Communication Network (ELCN) shall consist of high-speed BACnet/IP Local Area Network (LAN) and/or Wide Area Network (WAN) to host Operators Workstations (B-OWS), Building Controllers (B-BC), Building Level Communication Networks (BLCN) and Web-Enabled remote connectivity.
- D. Building Level Communication Network (BLCN) shall consist of a BACnet internetwork to host field level DDC Controllers
- E. B-BC"s shall automatically route BACnet communications to all configured available BACnet networks.
- F. B-OWS and B-BC"s shall be fully IT-compatible devices that communicate directly on a TCP/IP Local Area Network (LAN).
 - 1. LAN shall be 10/100Mbps TCP/IP with the following minimum requirements:
 - a. Minimum throughput: 10Mbps with the ability to increase to 100Mbps.
 - 2. Enterprise Level Communication Network (ELCN) shall provide communication between B- BC"s, B-OWS, remote B-OWS and Web Server using a B/IP LAN backbone.
 - 3. B-BC"s shall connect directly to the LAN and communicate using B/IP without a TCP/IP Gateway or network server.
 - 4. Owner shall be responsible for providing TCP/IP networking scheme, addressing, &c. It shall be the responsibility of the BAS Contractor to coordinate implementation of the BAS on the Owner's LAN without disruption.
- G. BAS Manufacturer must natively support the following BACnet data links as defined in the ANSI/ASHRAE Standard 135-2008, BACnet:
 - 1. Point-to-Point (PTP)
 - 2. Master Slave/Token Passing (MS/TP)
 - 3. Ethernet (ISO 8802-3)
 - 4. BACnet IP (B/IP)
- H. Field sensors and control devices shall connect to peer-to-peer, fully programmable B-BC, B-AAC & B-ASC as required to achieve the point monitoring and Sequence of Control as specified herein. All devices are to be monitored by a B-OWS. Final control devices are to be electronic.
- I. Each Mechanical System and/or major piece of Mechanical Equipment shall have one (1) dedicated DDC controller with sufficient I/O capacity such that it shall be

connected to ALL field devices and sensors associated with that system and/or piece of equipment. Distributed control of one (1) single piece of major mechanical equipment shall not be performed by multiple controllers.

J. All BAS controllers, sensors and devices shall be UL listed.

1. All BAS controllers and interface devices must be UL 916 Listed
2. Where required by the local Authority Having Jurisdiction (AHJ), all BAS controllers and interface devices must be UUKL-UL 864 Listed

1.5 MATERIAL FURNISHED UNDER THIS SECTION BUT INSTALLED UNDER OTHER SECTIONS

- A. Provide, supervise, and coordinate the installation of components supplied under this Section but installed under other Divisions of the specification.
- B. Automatic control dampers, airflow measuring stations, and duct-mounted airstream sensors and devices to be installed by Mechanical Contractor

1.6 RELATED SECTIONS

- A. Work related to this Section but covered by other Sections include but are not limited to:
 1. "Integrated Automation System Specification"
 2. "Heating, Ventilating and Air-Conditioning Specification"
 3. "Electrical System Specification"

1.7 QUALITY ASSURANCE

- A. The BAS Contractor shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship provided under this Specification Section.
- B. BAS components shall be manufactured by firms regularly engaged in the manufacture of equipment of the types, sizes and service required.
- C. The BAS Contractor shall be a factory certified contractor specializing and experienced in BAS installations and with experience in networked microprocessor based commercial HVAC, building and enterprise level control systems.
 1. BAS Contractor shall maintain a comprehensive service office location within 100 miles of project location prior to bid date and at a minimum until the completion of the warranty period.
- D. The BAS Contractor shall use technicians and application engineers certified by the manufacturer in the installation, configuration, programming, and service of the BAS products.

- E. The BACnet internetwork shall be based upon the Manufacturer's standard integrated hardware and software product design intent and in accordance with Manufacturer's installation and application documentation.
- F. To the highest extent practical, all BAS equipment of the same type serving the same function shall be identical and from the same manufacturer. All new B-ASC, B-AAC, B-BC, B-OWS software and web-server software shall be the products of a single manufacturer.

1.8 SYSTEM PERFORMANCE

- A. The system shall conform at a minimum to the following performance standards:
 - 1. Graphics shall display with a minimum of 50 dynamic real-time data points and within 10 seconds of the request.
 - 2. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds of being commanded to change.
 - 3. All changes of state or change of analog values shall be transmitted such that no reporting of a value is more than 15 seconds old.
 - 4. The maximum time from when an object goes into alarm to when it is annunciated at the B- OWS shall not exceed 20 seconds. Those points denoted as critical shall be annunciated within 5 seconds.

Table 1 – System Accuracy	
Measured Variable	Reported Accuracy
Space temperature	+/-0.5 deg C (+/-1 deg F)
Ducted air	+/-1.0 deg C (+/-2 deg F)
Outside air	+/-1.0 deg C (+/-2 deg F)
Water temperature	+/-0.5 deg C (+/-1 deg F)
Delta-T	+/-0.15 deg C (+/-0.25 deg F)
Relative humidity	+/-2% RH 10-90% RH
Water flow	+/-2% of actual value
Air flow (terminal)	+/-10% of actual value (Note 1)
Air flow (measuring stations)	+/-2% for calibrated range.
Air pressure (ducts)	+/-25 Pa (+/-0.1 "WG)
Air pressure (space)	+/-3 Pa (+/-0.01 "WG)
Water pressure	+/-1PSI (Note 2)
Electrical Power	±2% of Range (Note 3)
Carbon Monoxide (CO) Carbon Dioxide (CO ²)	+/-5% of Reading +/- 50 PPM
Note 1: (10% to100% of scale) (cannot read accurately below 10%)	
Note 2: for both absolute and differential pressure	
Note 3: * not including utility supplied meters	

5. B-BC, B-AAC, & B-ASC shall be able to execute control loops at a selectable frequency at least 1 time every second. The controller shall scan and update the process value and output generated by this calculation at this same frequency at a minimum.
6. All B-OWS on the network shall receive alarms within 5 seconds of each other.
7. No devices utilizing mercury shall be acceptable for any application.
8. Unless noted otherwise in these Specifications, the end-to-end accuracy from sensor to operator interface shall be as noted in Table 1.
 - a. Overall combined system repeatability of sensors, controllers and readout devices for a particular application shall be plus or minus 2% of full scale of the operating range. Repeatability of overall combined system of sensor, controller and readout device in a control loop application will be plus or minus 5% of full scale of the operating range.
 - b. Long-term electronic drift shall not exceed 0.4% per year.
9. The system provided shall be expandable to at least 500,000 hard points without additional database licensing fees, or replacing any devices, software or wiring provided herein.
10. All components provided as part of this system shall operate under ambient environmental conditions of 0°C (32°F) to 40°C (104°F) dry bulb and 10% to 90% relative humidity, non- condensing as a minimum. Sensors and control elements shall operate under the ambient environmental temperature, pressure, humidity, and vibration conditions encountered for the installed location. B-OWS equipment (hardware only), such as CRTs and printers, shall, unless designated otherwise, operate properly under ambient environmental conditions of 7°C (45°F) to 32°C (90°F) and a relative humidity of 10% to 90%.
11. Networked components of the system shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.

1.9 SUBMITTALS

- A. Submit under provisions of and pursuant with the [Division 15900] [Section 23 09] Specifications.
- B. All submittals and documentation including complete BAS System Engineering Design Submittal & Drawings, Project Record Documents, Application Engineering Documents and Owner's & Maintenance Manuals shall be submitted electronically in the form of an Adobe Portable Document Format (.pdf). All Control Schematics, Wiring Diagrams, Riser Diagrams, &c. shall be formatted for A3 11" x 17". All other documentation may be formatted for 8.5" x 11".
- C. Submit in writing and so delineated at the beginning of each submittal, known substitutions, and deviations from requirements of Contract Documents. Deviation from Contract Documents must be approved by the owner's representative prior to submittal.

- D. Complete BAS Engineering Design Submittal & Drawings shall be prepared pursuant with the following guidelines:
1. Submittal documentation and drawings shall consistently use the same abbreviations, symbols, nomenclature, and identifiers. Each control system element shall be assigned a unique identifier pursuant with the Contract Documents
 2. Submittal documentation and drawings shall have at the beginning an Index and Design Drawing Legend.
 - a. Index shall list all design drawings and elements including the drawing number, sheet number, drawing title, etc.
 - b. Legend shall show and describe all symbols, abbreviations and acronyms used on the Design Drawings
- E. Submit the following:
1. A complete bill of materials of all equipment, controllers, devices and sensors to be provided and/or used indicating unique equipment identifier/tag, unique device/controller identifier/tag, manufacturer and model number.
 2. Riser diagram of Building Level Communication Network (BLCN) and Enterprise Level Communication Network (ELCN) shall outline execution and details of all network cabling, BAS & Network Hardware including the following:
 - a. All BAS/DDC Hardware with controller number, unique identifier/tag, location, equipment and service
 - b. All Network Hardware with unique identifier, location and service
 - c. Network cabling configuration and execution specification.
 - d. Location of all cabling termination points and End of Line (EOL) terminators
 - e. Location of all network interface jacks
 - f. A separate riser diagram shall be provided for each network segment.
 3. A schedule of all control dampers. This shall include the unique equipment identifier, unique damper identifier/tag, damper size, pressure drop, blade configuration, orientation and axis of frame, blade rotation, location and selection criteria of actuators, nominal and actual sizes, and manufacturer and model number. The Damper Schedule shall include the AMCA 500-D maximum leakage rate at the operating static-pressure differential.
 4. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include for every BAS component including but not limited to the following:
 - a. Operator Workstation (B-OWS)
 - b. Building Controllers (B-BC)
 5. Provide shop drawings and/or manufacturer's standard specification submittal data sheets for all associated BAS equipment, sensors and control devices including unique identifier/tag, manufacturer model number and specific accessories, mounting, &c.

6. Sequence of Operation shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. No operational deviation from specified Sequences of Operation as outlined in Contract Documents shall be permitted without prior written approval. Sequences of Operation shall include and conform to the following:
 - a. Refer to equipment and control devices by their specific unique identifiers/tags pursuant with the Contract Documents and BAS Submittal package.
 - b. Clearly represent actual Application Programming methodology and functional control operation. Do not merely provide a copy of Contract Document specified Sequence of Control.
 - c. Include description of functional system operation under normal and failure conditions.
7. BAS Control Schematics and Wiring Diagrams shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. BAS Control Schematics and Wiring Diagrams shall include and conform to the following:
 - a. Control Schematic flow diagram of each system (air, water, gas, & etc.) being controlled showing actual physical configuration and control device/sensor location of all fans, coils, dampers, valves, pumps, heat exchangers, control devices, &c. including each hardware point type, controller and mnemonic.
 - b. Controller termination details showing every controller point termination, type and mnemonic.
 - c. Wiring Diagrams of all packaged equipment, motor starters, relay wiring, equipment interlock, safety circuits, & etc. clearly indicating all interconnecting wiring and termination of all conductors and cables including labels of all cables and point mnemonics.
 - d. Control Enclosure details for every enclosure including panel identifier, location, physical lay-out, dimensions, instrumentation, labels, & etc. Also include detail wiring (I/O, network and power) and power source for each panel, transformer and controller.
- F. Project Record Documents. Upon completion of installation and systems commissioning, submit record documents for review. "As-Built" Project Record Documents should include:
 1. Project Record Application Engineering Drawings shall include all BAS System Engineering Design Submittal with Drawings updated to reflect actual field conditions, architecture and execution.
 2. Operating & Maintenance (O&M) Manual including:
 - a. Operator's Manual with Manufacturers' complete operating instructions.
 - b. Programming Manual including:
 - 1) Documentation of all project specific Application and DDC programs
 - 2) All necessary system Administrator-Level passwords and/or required access credentials.

- 3) Information required for programming BAS.
 - 4) Complete Final Point Schedule including all hardware and software data points and documentation of calibration and configuration values for all Inputs, Outputs, Variables and PID Loops at the conclusion of systems commissioning and functional testing.
 - 5) Routine preventative maintenance procedures, corrective diagnostic troubleshooting procedures and calibration processes
 - 6) Final Bill of Material with all installed parts, manufacturers, manufacturers' part numbers and ordering information
 - 7) A schedule of recommended spare parts with part numbers and supplier
- c. Complete system database as functional at the conclusion of systems commissioning and functional testing including all graphics and images used by and/or created for BAS on electronic format as accepted by Owner.

1.10 CALIBRATION, COMMISSIONING, DEMONSTRATION AND ACCEPTANCE

A. Calibration and Commissioning

1. As a part of this contract, the BAS Contractor shall fully commission the entire BAS. All commissioning shall be fully documented, and all documentation shall be submitted prior to Demonstration and Acceptance testing. Commissioning shall include a "point-to-point" check-out of the following at a minimum:
 - a. Verify that all Temperature Control Panels (TCP), BAS equipment, controllers, devices and sensors are installed and operational according to the specifications, submittals and manufacturer's installation and application instructions.
 - b. Test, calibrate and bring on-line every control device.
 - c. Calibrate all inputs by comparing the actual site condition with the B-OWS point display.
 - d. Verify all outputs from B-OWS command to observed response of controlled device.
 - e. Verify failure response and fail-safe conditions of all devices and safeties.
 - f. Each control program shall be fully commissioned and tested for complete design intent compliance and functionality.
 - g. Verify overall network performance of BAS for complete design intent compliance and functionality with all devices on-line, communicating and fully operational.
 - h. Subsystems not directly controlled by the BAS but associated with the ATC shall also be fully tested and commissioned as to design intent compliance and functionality.

B. Demonstration and Acceptance

1. As a part of this contract, the BAS Contractor shall demonstrate compliance of the BAS with the contract documents and operational functionality pursuant with

the design Sequences of Operation. Using the documented calibration and commissioning test data the Owner and/or his representative shall select, at random, results to be demonstrated. At least 95% of the results demonstrated must perform as specified and documented on commissioning data sheets or the system must be re-calibrated and re-commissioned before being re-tested.

2. When the Calibration, Commissioning, Demonstration and Acceptance process has been completed and approved by Owner, Contractor shall be provided with signed letter from Owner indicating Acceptance within ten (10) days of approval.

1.11 TRAINING

- A. As a part of this contract, the BAS Contractor shall provide instruction on the adjustment, operation and maintenance of the BAS as installed including all hardware and software provided by a manufacturer-trained, competent application engineer and/or technician with sufficient experience in the installation, programming and operation of the BAS. All training equipment and material shall be provided by this Contractor.
- B. Training shall be scheduled within thirty (30) days of BAS Acceptance and shall consist of a 1-day operational training program for up to 4 operators at the discretion of the owner. A training day shall be defined as an 8-hour day of instruction Monday through Friday during regular working hours, including two (2) 15-minute breaks and excluding lunchtime and travel.
- C. 1 day of on-site training shall cover the entire execution of the complete BAS and components. Training shall be performed on the Owner's ATC/BAS and shall include:
 1. Location of all TCP's, Control Enclosures, controllers, devices, sensors, &c.
 2. Equipment Layout
 3. Sequences of Operation
 4. Maintenance and Repair
 5. Troubleshooting
 6. Preventative Maintenance
 7. Sensor Calibration
 8. Proper Use of Service Tools and Materials
- D. At the discretion of the Owner, on-site training and installed system demonstration sessions may be video-taped.
- E. Instructor shall provide one (1) copy of training materials for each attendee at the time of the training. Two additional copies of training materials shall be provided to Owner at time of training at the request of the Owner for archival. Training materials shall include:
 1. Agenda
 2. Defined objectives for each lesson
 3. Copies of audio-visuals and/or Power Point Presentations

1.12 WARRANTY, MAINTENANCE, NORMAL AND EMERGENCY SERVICE

- A. BAS manufacturer shall warranty all DDC controllers to be free of defect in material and workmanship under normal operation and expected service as published by the manufacturer in the unit's performance specifications for a period of five (3) years at a minimum.
 - 1. BAS manufacturer shall warranty all DDC controller on-board integral carbon dioxide (CO₂) sensing elements to be free of defect in material and workmanship under normal operation and expected service as published by the manufacturer in the unit's performance specifications for a period of two (2) years at a minimum.
 - 2. BAS manufacturer shall warranty all DDC controller on-board integral relative humidity (RH) sensing elements to be free of defect in material and workmanship under normal operation and expected service as published by the manufacturer in the unit's performance specifications for a period of one (1) year at a minimum.
- B. As a part of this contract, the BAS Contractor shall warranty all other components of the BAS and installation to be free of defects in workmanship and material under normal expected service and use for a period of one (1) year from the date of final acceptance of the BAS by the Owner.
- C. During the installation warranty period the Contractor shall provide all labor and materials required to repair or to replace all items or components that fail due to defects in workmanship or manufacture at no charge or reduction in service to the Owner.
- D. Except in the event of property loss or damage, warranty service shall be provided during regular working hours Monday through Friday at no charge unless otherwise explicitly outlined in the Contract Documents.
 - 1. Emergency service performed outside of these parameters shall be performed for charge by BAS Contractor according to the provisions set forth in the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. LynxSpring
- B. Honeywell
- C. JCI
- D. The WEB Server Hardware shall comply with the following:
 - 1. Operating System: Microsoft Windows Server 2003 Standard Edition or Microsoft Windows Server 2008 Standard Edition

- a. Where multiple simultaneous user access is not required, hardware platform may alternately be at a minimum Microsoft Windows XP Professional SP2 or Vista
2. Processor: Pentium Quad Core 2 GHz
3. Memory: 2GB
- E. The WEB Server Database shall comply with the following:
 1. Complete controller database of each B-BC, B-AAC, and B-ASC shall reside (at a minimum) within the respective device. The Web Server Hardware may retain and utilize a backup of the database within each device; however, the complete and original database must reside in the B-BC, B-AAC, and B-ASC.
- F. The WEB Server Software shall comply with the following:
 1. Provide licensed copy of the Control System WEB Enabled Application Software described in Section 2.4. This license shall allow unlimited isolated systems to be served, and access by an unlimited number of users.
 2. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
 - a. Manufacturer's Standard Software and Firmware licensing agreement shall be executed by Owner in writing prior to software acquisition and/or installation.

2.2 WEB ENABLED APPLICATION SOFTWARE

- A. The WEB Enabled Application software and Graphical User Interface (GUI) is to be stored on the WEB hard disk drive server. WEB Enabled Applications that require system graphics to be stored on the client machines will not be acceptable. The application shall support unlimited access by 20 simultaneous clients using standard Web browser such as Internet Explorer.
- B. The WEB enabled application shall perform native BACnet communications directly to all BACnet devices on the BACnet internetwork. Applications that require translation of data, gateways, or mapping of any kind shall not be acceptable.
- C. The WEB Enabled Application shall provide the same methodology as the B-OWS application when viewing the BACnet Internetwork in terms of network architecture, system graphics, calendars, logs, etc. Systems utilizing Web Enabled Applications and Control Operator Workstation Applications of different manufacturer shall implement both applications so that the methodology is the same. Control Systems that utilize different methodology between the WEB Enabled Application and the Control System Operator Workstation Application for network architecture views, system graphic presentation or request, object, schedule or alarm interaction will not be acceptable.

- D. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
- E. Users shall have administrator defined access privileges. Depending on the access privileges assigned, the user shall be able to utilize those features described herein at different levels of interface varying between View only and Modify.
- F. HTML programming shall not be required to create or display system graphics or data on a Web page.
- G. A new point displayed on a B-OWS graphic screen shall appear automatically on the identical graphic screen served by the web-server with no further programming or file transfer required.
- H. The WEB Enabled Application shall support via the Web Browser client the following as it is described in the Control System Operator Workstation Application as a minimum:
 - 1. Password Protection
 - 2. Alarming and Event Notification
 - 3. Weekly, Annual and Special Event Exception Scheduling
 - 4. Trend Log Graphing, and the capability to export in ASCII and Microsoft Excel format.
 - 5. Runtime Log Information
 - 6. Ability to Manually Override any Database point.
 - 7. Ability to Adjust any Setpoint.
- I. The WEB Enabled Application shall support via the Web Browser client the following in addition to what is described above:
 - 1. Color Graphical User Interface (GUI)
 - a. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet internetwork to the browser without operator intervention. Manual operator intervention shall use the same methodology as on the B-OWS application.
 - b. Depending upon configured access level; the operator shall be able to manually adjust digital, analog or calculated values in the system, adjust values of control loops, override points or release points to automatic mode.
 - 2. System Graphic screens developed for the B-OWS shall be the same image file used for the Web Browser Client. Systems which require special translation or re-export of graphics to accommodate the web domain, will not be accepted. The Web Browser client shall support any System Graphic animation supported by the B-OWS. System Graphic screens on the Web Browser client shall support hypertext links to other location on the Internet or on Intranet sites by specifying the Uniform Resource Locator (URL) for the desired link.

- J. The WEB Enabled Application shall provide the capability to create a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to a defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- K. The WEB Enabled Application shall include an Audit Trail feature that automatically records the time, date, and user, and action associated with all user changes made via Web Browser clients.
- L. The WEB Enabled Application shall store complete help files describing system configuration, and use of the Browser Client interface. The help files shall be served on-line as part of the Browser Client interface. Creation, storage and serving of custom-made help files by the owner shall be possible, in lieu of the manufacturer's help files.

2.3 OPERATORS WORKSTATION PLATFORM (B-OWS)

- A. Provide as specified herein complete all associated Operating System, Operators Workstation Application Software and Third-Party Software Applications preloaded and configured.
- B. Local Operators Workstation (B-OWS) shall be PC-based desktop workstation. Common BAS database and graphic files shall be stored on workstation designated and acting as the system server. Workstation Hardware minimum requirements are as follows:
 - 1. Intel Pentium IV 3 GHz Processor
 - 2. 2 GB RAM
 - 3. 10 GB or larger hard disc drive with 12 millisecond access time
 - 4. 16x DVD+/-RW
 - 5. 22" Flat Panel LCD Monitor and 128 MB high performance graphics adapter with a minimum resolution performance of at least 1680 x 1050.
 - 6. Tower case with at least two spare drive slots and 3 spare board slots.
 - 7. At least one (1) Ethernet 10/100 Network Interface Card (NIC)
 - 8. At least four (4) USB 2.0 ports
 - 9. Enhanced style keyboard with 101 key layout, 10 function keys, numeric keypad and separate cursor control pads.
 - 10. Two button mouse with adjustable sensitivity and desk pad.
 - 11. All necessary cables
 - 12. A combination surge suppressor/UPS dedicated to this server and printer.
 - 13. Provide an integral audio tone generator to activate on detection of an alarm. Audio tone shall be capable of being enabled or disabled on operator command.
- C. Communications and Protocols
 - 1. B-OWS information access for the control system shall utilize Niagara/BACnet protocol only for communication to B-BC"s, B-AAC"s, B-ASC"s and all other BAS DDC controllers.

2. B-OWS shall reside on the same LAN as B-BC"s. B-OWS shall as a minimum support point-to-point (PTP) and BACnet/IP physical/data link layer protocols.
 3. The B-OWS specified here may, at the Owner's option, be located remote from the BACnet internetwork. Other than the difference in B-OWS communication speed, the system shall be capable of remote operation via BACnet LAN types with no degradation in application performance.
- D. B-OWS Operating System (OS) Software shall be consistent on all B-OWS hardware platforms provided.
- E. The B-OWS hardware platform OS shall be Microsoft Windows XP Professional Service Pack 2 or newer or Microsoft Windows Vista Business, or newer.

2.4 CONTROL SYSTEM OPERATOR'S WORKSTATION APPLICATION SOFTWARE

- A. The B-OWS Software shall be provided, licensed and installed on at least one B-OWS Platform. If more than one Platform is provided a licensed copy of the B-OWS Software shall be provided for every Platform.
- B. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
1. Manufacturer's Standard Software and Firmware licensing agreement shall be executed by Owner in writing prior to software acquisition and/or installation.
- C. The B-OWS Software shall be BTL listed as either a B-OWS or B-AWS.
- D. Password Protection
1. Multiple-level password access protection shall be provided.
 2. Passwords shall be exactly the same for all software applications provided to communicate with the internetwork.
 3. A minimum of 10 levels of access shall be supported with a configurable matrix of operator actions allowed for each access level, broken down into at least 200 possible operator actions.
 4. A minimum of 50 passwords shall be supported at each B-OWS.
 5. Operators will be able to perform only those commands available for their respective passwords.
 6. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving B-OWS in an unsupervised logged-in state.
- E. Alarming and Event Notification
1. B-OWS shall utilize BACnet Alarm Events and PICS shall support at a minimum the following BIBBs:

- a. Alarm and Event – Acknowledge-A (AE-ACK-A)
 - b. Alarm and Event – Notification-A (AE-N-A)
 - c. Alarm and Event – Alarm Summary View-A (AE-AS-A)
 - d. Alarm and Event – View and Modify-A (AE-VM-A)
 - e. Alarm and Event – View Notifications-A (AE-VN-A)
2. B-OWS terminal shall provide audible, visual, and printed means of alarm and event notification.
3. System shall provide log of notification messages. Complete Alarm log of all system and operator transactions shall be archived to the hard disk of the system B-OWS.
4. Alarm messages shall be in user-definable text (English or other specified language) and shall be entered either at the B-OWS terminal or via remote communication.
5. An alarm summary shall be available to show all alarms whether including but not limited to whether or not they have been acknowledged.
6. System shall provide ability to prioritize and differentiate communications for at least 20 different levels of alarms.
7. Alarm messages shall be fully customizable in size, content, behavior and sound.

F. Weekly Annual and Special Event Scheduling

1. B-OWS Software shall utilize BACnet Schedules and PICS shall support at a minimum the following BIBBs:
 - a. Scheduling – Advanced View and Modify-A (SCH-AVM-A)
2. Provide ability to view and modify the schedule for the calendar week and up to 255 special events in a graphical format. Each calendar day and special event shall provide at least six time/value entries per day.
3. Provide the ability for the operator to select scheduling for either binary, analog, or multi-state object values.
4. Provide the ability for the operator to designate days, date ranges, or repeating date patterns as exception schedules.
5. Provide the capability for the operator to define special or holiday schedules and to link the BACnet schedule to a BACnet calendar, thereby over-riding weekly schedule programming on holidays defined in the BACnet calendar.
6. There shall be a provision with proper password access to manually override each schedule.
7. Provide the capability to designate any exception schedule to be “Executed Once” then automatically cleared.
8. Provide the ability to name each exception schedule with a user defined term to describe each special event.

G. Trend Log Graphing

1. B-OWS Software shall allow viewing of BACnet Trend Logs and PICS shall support at a minimum the following BIBBs:
 - a. Trending – View-A (T-V-A)

2. All data points (both hardware and software) system-wide shall be assignable to a historical trending program by gathering configurable historical samples of object data stored in the local controller (B-BC, B-AAC, B-ASC).
3. All trend log information shall be displayable in text or graphic format. All information shall be able to be printed in black & white or color and exported directly to a Microsoft Excel Spreadsheet.
4. Long-term archives shall be automatically stored on the B-OWS platform or automatically stored onto a dedicated server using an SQL database data acquisition service. The B-OWS and/or SQL Database Application shall perform the following at a minimum:
 - a. Be capable of automatically retrieving any trend-log from any device on the network without user-intervention.
 - b. Manage connection to internetwork automatically based upon configurable data acquisition thresholds; retrieving data only when necessary, rather than streaming data
 - c. Generate standard, secure SQL database accessible by third-party applications.
 - d. Shall operate as a Microsoft Windows service.
 - e. Archived data shall be limited only by SQL license and hard disk space available.
 - f. Be capable of exporting data directly to Microsoft Excel
 - g. Not require a separate "viewer" but shall seamlessly present all archived data together with real-time data stored in device using the standard B-OWS Trend Log Viewer.

H. Runtime Log Information

1. B-OWS Software shall be capable of displaying Runtime and On/Off Cycle data of all Binary data points (both hardware and software) system-wide. Runtime logs shall provide the following at a minimum:
 - a. Total Accumulated Runtime
 - b. Accumulated Starts Today
 - c. Total Accumulated Starts
 - d. Timestamp each Start/Stop and duration of each on/off cycle.
 - e. Monitor equipment status and generate maintenance messages based upon user designated run time.

I. System Configuration, Set-Up and Definition.

1. Device and network status shall be displayed for any device on the BACnet internetwork. At a minimum the following Device Management BIBBs shall be supported:
 - a. Device Management – Automatic Device Mapping-A (DM-ADM-A)
 - b. Device Management – Automatic Network Mapping-A (DM-ANM-A)
 - c. Device Management – Reinitialize Device-A (DM-RD-A)

2. All control strategies and energy management routines shall be stored in the controller and shall allow modification and additions by the operator using the B-OWS software. No strategies or routines shall be stored on the B-OWS platform.
3. B-OWS Software shall have the capability to back-up and restore the programming and database of any BACnet device on the BACnet internetwork. The B-OWS BTL listing shall support the Device Management – Backup and Restore-A (DM-BR-A) BIBB.
4. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system.

J. Graphical User Interface (GUI)

1. B-OWS Software shall support at a minimum BMP, GIF, TIF, JPG, EMF, PNG, SWF and DIB graphic file formats and allow for the use of custom Flash animation objects and URL hyperlinks in every GUI.
2. B-OWS Software shall provide a color graphics package to allow the user to generate custom dynamic graphics for graphical representation of system design and system parameters. Graphic images may reside on the B-OWS or server; however, all dynamic data and attributes must reside in the controller.
 - a. A listed set of symbols and graphic slides shall be available to allow operators to select from the graphics table to assist in graphic generation.
 - b. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet internetwork to the B-OWS workstation without operator intervention.
 - c. The operator shall be able to manually adjust all data point values (hardware or software) in the system, adjust values of control loops, and command points to local mode or release points to automatic mode.
 - d. The windowing environment of the B-OWS shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, and/or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
 - e. Pre-packaged animations for display of fans, pumps, dampers, etc., and shall allow custom user created .swf and .gif animations to be used to display objects on graphic displays.
 - f. The contractor shall submit all new graphics to the owner's representative for approval.

- K. The BAS shall be provided with fully automatic diagnostic procedures for verification of internetwork communication. In the event of communications failure, the system shall automatically Alarm the condition. B-OWS Software shall be capable of remote annunciation to printer, pager and e-mail.

L. Control Summaries, Reports and Logging:

1. The system shall provide self-documentation reporting to summarize control strategies for any point or any user selected group of points within the Control System.
2. The B-OWS reporting package shall allow the user to configure the point information display in custom format.

3. The B-OWS shall enable operator to perform Wild Card data point sorting and searches.
4. The B-OWS shall perform automated network back-up of runtime databases in all devices on the BACnet network according to operator configurable schedule and storage directory structure.

2.5 BUILDING CONTROLLERS (B-BC)

- A. B-BC shall comply with all aforementioned BAS System Requirements and shall comply with the BACnet profile for Building Controllers (B-BC) and shall be equal to Jenesys Edge 534 –AX controllers.
- B. Furnish B-BC(s) as necessary to control large point count major mechanical equipment, and execution of BAS global strategies, and as noted in the execution portion of this specification.
 1. Each Mechanical System and/or major piece of Mechanical Equipment (e.g., Chilled Water, Heating Water, Large AHU, etc.) shall have one (1) dedicated DDC controller with sufficient I/O capacity such that it shall be connected to ALL field devices and sensors associated with that system and/or piece of equipment. Distributed control of one (1) single piece of major mechanical equipment shall not be performed by multiple controllers.
 2. Each B-BC shall support local hardware Inputs and Outputs (I/O) by the use of on-board I/O and/or I/O expansion modules.
- C. B-BC shall be capable of locally executing global strategies for the BAS based on information from any object in the internetwork. Control Systems that require a higher-level host processor for update, time stamps, global point data, COS transfer, on-line control instruction, or communications control between B-BC panels shall not be acceptable.
- D. BAS shall communicate with all B-OWS, B-BC, B-AAC & B-ASC on a peer-to-peer basis, and shall provide real-time clock functions for scheduling and network-wide time synchronization.
- E. B-BC shall have sufficient memory to support its operating system, database, and programming requirements. Battery/capacitor shall retain static RAM memory and clock functions for a minimum of 72 hours.
 1. B-BC operating system, field database, and application programs shall reside in EEPROM.
 2. B-BC run-time field database and application programs shall reside in battery backed-up on-board memory or EEPROM.
- F. B-BC shall comply with the following Hardware Configuration:
 1. B-BC shall have integral power switch. If the device manufacturer provides no on-board switch, then the System Contractor shall provide a separate dedicated transformer and switch within each enclosure for each controller

- present B-BC shall provide diagnostic LEDs for power, communications and processor status. The B-BC shall continually check the status of its processor and memory circuits.
2. Controller wiring terminals shall be removable terminal strips for ease of installation and service replacement.
 3. All hardware inputs shall be Universal (i.e., binary or analog) configured on hardware and/or in software.
 - a. Inputs shall accept dry-contact, thermistor, 4-20 mA, and 0-5VDC.
 - b. Pulse accumulation shall accommodate a maximum frequency of 40Hz.
 - c. Inputs shall have a minimum 10 Bit A/D conversion resolution.
 - d. 24VAC over-voltage protection
 - e. Status LED indicators for each input
 4. All hardware outputs shall be Universal and configured on hardware and/or in software.
 - a. Outputs shall provide configurable modulating voltage signal to industry standard 0- 5VDC and 0-10VDC analog control devices and relays.
 - b. Outputs shall be capable of sourcing 75mA at 12VDC.
 - c. Outputs shall have a minimum 8 Bit D/A conversion resolution.
 - d. 24VAC over-voltage and short protection
 - e. On-board integral physical Hand-Off-Auto (H-O-A) Switch for every output. H-O-A switch position shall be monitored and displayed by B-BC.
 - 1) In addition to H-O-A switch, Universal Outputs shall be provided with on- board integral potentiometer for manual adjustment of analog modulating voltage signal in conjunction with the Hand position.
 - f. Status LED indicator for each output
- G. B-BC shall interact with the Control System Application Software in compliance with the following:
1. Database programming, configuration and modification shall be accomplished through the B- OWS online with the B-BC. The complete database and application program shall reside in the B-BC. The System Contractor shall configure the software to attain the proper sequence of control and to accomplish all other control system functions indicated in the Contract Documents.
 2. The B-BC shall function in a real-time, multi-tasking networked operating environment; able to display database values, programs, and control loops in real-time while functional and online using the B-OWS. The user shall be able to add, delete, or modify objects on-line as required without taking the B-BC offline. The programming shall provide all the necessary mathematics, logic, utility and control functions necessary to execute the specified sequence of control.
- H. All required application programming shall be resident in the B-BC, B-AAC & B-ASC, and third party BACnet devices, and not in the B-OWS.

- I. B-BC shall manage system-wide alarms by performing distributed, independent alarm analysis and filtering. At no time shall the B-BC panel's ability to report alarms be affected by either operator activity at a B-OWS or local I/O device, or communications with other B-BC on the network.
 - 1. B-BCs shall have capability to broadcast alarm conditions automatically across the BLCN. Alarm Event notifications shall be sent to off-site computer or serial printer. A minimum of one B-BC per site shall be capable of sending SMTP email messages to an email server for configured alarm conditions.
 - 2. Active Alarm Events log shall be stored on the B-BC and may be viewed locally or remotely.
 - 3. All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
 - 4. The user shall be able to define the specific system reaction for each point alarm and shall be able to customize reaction and filtering to minimize nuisance reporting. Each B-BC panel shall automatically inhibit the reporting of selected alarms during the standby power modes of operation, loss of power, fire alarm mode, and normal system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 - 5. Alarm reports, messages, and files can be directed to a user-defined list of operator devices, or PCs used for archiving alarm information.
- J. B-BC shall perform and manage historical data collection. Minimum sampling time shall be configurable with a minimum sample rate of once per second.
 - 1. B-BC panels shall store point history files for all analog and binary inputs and outputs.
 - 2. Measured and calculated analog and binary data shall also be assignable to user- definable trends.
 - 3. Up to six points of any type can be assigned to a single trend log.
 - 4. Trend data shall be stored at the stand-alone B-BC panels and uploaded to hard disk storage automatically at preconfigured intervals when archival is desired. Separate archival application software will be accepted.
- K. Stand-alone B-BC panels shall automatically accumulate and store runtime hours for binary input and output points.
- L. B-BC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
- M. B-BC panels shall have the ability to count and/or execute events on a daily, weekly, or monthly basis.
- N. Communication and Protocols
 - 1. The B-BC shall continuously scan the BACnet network and maintain a current database of field data in on board battery/capacitor backed RAM or EEPROM, including alarms, passwords, binding tables, device status, etc. The B-BC shall communicate with BACnet devices on the BLCN using the BACnet physical data

- link MS/TP at a baud rate of 76.8 Kbps where not limited by third party BACnet devices such as drives, utility meters, etc..
2. The B-BC shall provide a communications port for connection of the Portable Operators Terminal using Point-to-Point BACnet physical data link layer protocol or a connection to the network using BACnet/IP.
 3. B-BC shall support and be capable of monitoring and controlling a network of communicating remote space sensors. These networked sensors shall occupy input/output hardware points in the B-BC. All Software points must be preapproved by Utility Service BMS manager.
 4. Provide all functions that will allow remote communications via modem to off-site locations. Include modem along with all cabling necessary for installation.
 5. B-BC shall support at a minimum of two (2) distinct dedicated BACnet/IP (B/IP) data link networks using TCP/IP and one (1) BACnet/Ethernet data link network simultaneously
 6. B-BC shall support integral communication using Modbus RTU and TCP protocols as both a Slave and Master for building systems third-party integration.
 7. B-BC shall support SMTP and provide stand-alone remote annunciation of alarms via e-mail without additional hardware, B-OWS, or web-server.
 8. B-BC shall support, transmit, and receive of segmented messages.

2.6 ADVANCED APPLICATION CONTROLLERS (B-AAC)

- A. B-AAC shall comply with all aforementioned BAS System Requirements and shall comply with or exceed the BACnet profile for Advanced Application Controllers (B-AAC).
- B. Furnish one dedicated B-AAC(s) for each small or medium sized mechanical system, as noted in the execution portion of this specification. Each B-AAC shall acquire, process, and store point input data on a real time basis for internal use and for sharing with other controllers. Each B-AAC shall also maintain and supervise digital and analog output signals to the control devices and have a real time operating system capable of time of day scheduling and other time based functions.
 1. If the hardware point requirements of any medium-sized system should exceed the I/O configuration of available B-AAC offerings then a B-BC must be used. Control of one piece of mechanical equipment may not be performed by more than one controller.
- C. B-AAC shall provide microprocessor based self-contained stand-alone fully programmable operation of local process control loops. All local level application programs shall be installed on individual controllers in non-volatile memory.
- D. Each B-AAC shall be capable of sharing point information with other B-BC, B-AAC, or B-ASC on a peer-to-peer basis via the BACnet BLCN.
- E. Control systems that utilize „canned“ programs or programmable read only memory (PROM) level application programming are not acceptable.

- F. Once downloaded, a B-AAC shall not require further communication with the B-OWS except for data base changes, operator commands, and requests from the B-OWS for B-AAC data. Programming of B-AACs shall be completely modifiable in the field, over the installed BACnet network or remotely via the internet.
- G. Each B-AAC shall be provided with the ability to prevent unauthorized access to its software program.
- H. B-AAC shall have sufficient memory to support its operating system, database, and programming requirements.
 - 1. B-AAC operating system, field database, and application programs shall reside in EEPROM.
 - 2. B-AAC run-time field database and application programs shall reside in on-board memory or EEPROM.
- I. B-AAC shall feature real-time 24-hour clock and 365-day calendar. Battery or capacitor back-up of these functions is required where the B-AAC is installed as a standalone controller.
- J. B-AAC shall be designed for wall-mounting to a single or double-device box in the space
- K. B-AAC shall include on-board integral LCD User Interface for display and modification of local and/or networked BAS data points as follows:
 - 1. LCD screen shall be a minimum of 128 x 64 pixels in a viewable area no smaller than 62mm x 44mm (2.4" x 1.7")
 - 2. LCD screen shall feature back-lighting configurable for constantly lit or user-defined time out periods with user-adjustable contrast
 - 3. B-AAC shall feature push-buttons on the face of the controller for user navigation of the local display screens and for entering values and overriding points.
 - 4. LCD interface shall be capable of displaying and acknowledging local Alarms
 - 5. LCD interface shall provide as a minimum eight (8) configurable display screens each capable of displaying a minimum of six (6) local and/or networked data points
 - a. All displayed data points shall be configurable as display only or capable of being modified via the interface
 - b. Display shall support at a minimum three (3) user-defined password-protected security permission levels restricting read/write privileges of all displayed data points
 - c. Ability to edit the annual and weekly schedules from the display
- L. B-AAC shall feature a software configurable audible enunciator which shall be configured to trigger on the occurrence of selected alarms, and shall be audible and acknowledgeable either to all users, or only to those users with sufficient password authority.

M. B-AAC shall comply with the following Hardware Configuration:

1. B-AAC shall provide diagnostic LEDs for power, communications and processor status. The B-AAC shall continually check the status of its processor and memory circuits Universal field device hardware inputs shall be provided and configured on hardware and/or in software and comply with the following:
 - a. Inputs shall accept dry-contact, thermistor, 4-20 mA, and 0-5VDC
 - b. Pulse accumulation shall accommodate a maximum frequency of 100Hz
 - c. Inputs shall have a minimum 10 Bit A/D conversion resolution
 - d. 24VAC over-voltage protection
2. In addition to field device Hardware inputs, the B-AAC shall feature the following on-board integral hardware inputs at a minimum:
 - a. Temperature sensor (local or remote)
 - 1) 10k Thermistor
 - 2) 0°C to 40°C (32°F to 104°F) range 3) +/- 0.1°C (+/- 0.18°F) resolution
 - 3) User calibrated +/- 0.1°C (+/- 0.18°F)
 - b. Setpoint Adjustment Slider
 - 1) 20k potentiometer
 - 2) Range defined, limited and configured via Application Software
 - c. Relative Humidity (RH)
 - 1) 10% – 90% range
 - 2) 0.1% resolution
 - 3) +/- 2% accuracy
 - 4) Replaceable sensing element
 - 5) User calibrated as necessary
 - d. Occupancy
 - 1) Passive Infrared Radiation (PIR)
 - 2) 5m/16.4" detection distance
 - 3) 100° horizontal / 82° vertical detection
 - 4) 64 detection zones
 - e. Carbon Dioxide (CO2)
 - 1) 0 – 2000ppm
 - 2) +/- 30ppm Accuracy
 - 3) Auto-Drift Calibration
3. Hardware Outputs shall be configured as to be modular in nature and support the following characteristics:

- a. Universal Output
 - 1) 0 – 12 VDC @ 75 mA
 - 2) Digital or Analog functional operation
- b. Single Stage Relay
 - 1) SPDT Form C Dry Contact
 - 2) Minimum 0.5 A @ 24 VAC/VDC Contact Rating
 - 3) NO/NC Selectable
- c. Single Stage TRIAC
 - 1) Single NO Contact for Switching AC Loads
 - 2) Minimum 0.5 A @ 24 VAC/VDC Contact Rating
 - 3) Minimum Switching Current of 20 mA
- 4. Universal hardware outputs shall be provided and configured on hardware or in software and comply with the following:
 - a. Universal Outputs shall provide configurable modulating voltage signal to industry standard 0-5VDC and 0-10VDC analog control devices and relays
 - b. Outputs shall be capable of sourcing 75mA at 12VDC
 - c. Outputs shall have a minimum 8 Bit D/A conversion resolution
 - d. 24VAC over-voltage and short protection

N. Control System Application Software:

- 1. The B-AAC application software shall be the same as and indistinguishable from the B-BC specified interaction with the Control System Application Software.
- 2. The controller software shall reside in a real time, multi-tasking, networking operating environment. Database definition shall be accomplished through the B-OWS online with the B-AAC. The complete database and application program shall reside in the B-AAC. The System Contractor shall configure the software to attain the proper sequence of control and to accomplish all other control system functions indicated in the Contract Documents.
- 3. The user shall be able to add, delete, or modify objects on-line as required. The programming shall provide all the necessary mathematics, logic, utility and control functions necessary for proper sequence of control.

O. Communications and Protocols

- 1. The B-AAC shall communicate with field devices and controllers on the BLCN using the BACnet physical data link MS/TP at 76.8 Kbps where not limited by third party devices such as variable speed drives, utility meters, ect.
- 2. The B-AAC shall provide a communications port for connection of the Portable Operators Terminal using Point-to-Point BACnet physical data link layer protocol or a connection to the network.

3. B-AAC shall support and be capable of monitoring and controlling a network of a minimum of four (4) communicating remote space sensors. These networked sensors shall not consume input/output hardware points in the B-AAC.
- P. B-AAC shall perform and manage historical data collection. Minimum sampling time shall be configurable with a minimum sample rate of once per second.
1. B-AAC panels shall store point history files for all analog and binary inputs and outputs.
 2. Measured and calculated analog and binary data shall also be assignable to user-definable trends.
 3. Up to six points of any type can be assigned to a single trend log.
 4. Trend data shall be stored at the stand-alone B-AAC panels, and uploaded to hard disk storage automatically at preconfigured intervals when archival is desired. Separate archival application software will be accepted.
- Q. Stand-alone B-ASC panels shall automatically accumulate and store runtime hours for binary input and output points.
- R. B-ASC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
- S. B-ASC panels shall have the ability to count and/or execute events on a daily, weekly, or monthly basis.
- T. B-AAC shall support, transmit, and receive of segmented messages.
- 2.7 APPLICATION SPECIFIC CONTROLLERS (B-ASC)
- A. B-ASC shall comply with all aforementioned BAS System Requirements and shall comply with the BACnet profile for Application Specific Controllers (B-ASC).
 - B. Provide one dedicated B-ASC for each Terminal Unit Mechanical Device on the project. Those include Variable Air Volume (VAV) Air Terminal Units (ATU), Serial and Parallel Fan-Powered (FP) VAV ATU's, Unit Heaters (UH), Unit Ventilators (UV), Fan Coil Units (FCU), Roof-Top Units (RTU) and Individual Fans. Terminal Units specifically called out in the sequence of operation, as "Non- DDC" shall be excluded from this requirement.
 - C. B-ASC shall provide microprocessor based self-contained stand-alone fully programmable operation of local process control loops. All local level application programs shall be installed on individual controllers in non-volatile memory.
 - D. Each B-ASC shall be capable of sharing point information with other B-BC, B-AAC, or B-ASC on a peer-to-peer basis via the BACnet BLCN.
 - E. Control systems that utilize „canned“ programs or programmable read only memory (PROM) level application programming are not acceptable.

- F. Once downloaded, a B-ASC shall not require further communication with the B-OWS except for data base changes, operator commands, and requests from the B-OWS for B-ASC data. Programming of B-ASCs shall be completely modifiable in the field, over installed BACnet Internetwork or remotely via modem.
 - 1. Each B-ASC shall be provided with the ability to prevent unauthorized access to its software program.
 - 2. B-ASC shall have sufficient memory to support its operating system, database, and programming requirements.
 - 3. B-ASC operating system, field database, and application programs shall reside in EEPROM.
 - 4. B-ASC run-time field database and application programs shall reside in on-board non-volatile memory or EEPROM.
- G. ASC shall perform and manage historical data collection. Minimum sampling time shall be configurable with a minimum sample rate of once per second.
 - 1. B-ASC panels shall store point history files for all analog and binary inputs and outputs.
 - 2. Measured and calculated analog and binary data shall also be assignable to user-definable trends.
 - 3. Up to six points of any type can be assigned to a single trend log.
 - 4. Trend data shall be stored at the stand-alone B-ASC panels, and uploaded to hard disk storage automatically at preconfigured intervals when archival is desired. Separate archival application software will be accepted.
- H. Stand-alone B-ASC panels shall automatically accumulate and store runtime hours for binary input and output points.
- I. B-ASC panels shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
- J. B-ASC panels shall have the ability to count and/or execute events on a daily, weekly, or monthly basis.
- K. B-ASC for VAV ATU"s application shall comply with the following:
 - 1. B-ASC shall be provided with integral damper actuator. Actuator shall feature the following at a minimum:
 - a. 35 in-lbs. of torque
 - b. Brushless DC Operator
 - c. Actual damper position feedback. Drive time or other software calculated damper position shall not be accepted
 - d. Damper End Switch using motor current sense or equivalent for positive feedback of both end stop positions
 - e. Software selectable rotation

2. B-ASC shall be provided with integral differential pressure transducer, with range of 0–1 in.wc., +/-5% FS.
 3. Universal field device hardware inputs shall be provided and configured on hardware and/or in software and comply with the following:
 - a. Inputs shall accept dry-contact, thermistor, 4-20 mA, and 0-5VDC
 - b. Pulse accumulation shall accommodate a minimum frequency of 40Hz
 - c. Inputs shall have a minimum 10 Bit A/D conversion resolution
 - d. 24VAC over-voltage protection
 4. Hardware outputs for field devices shall be provided as follows:
 - a. Three (3) Universal Outputs or One (1) Universal Output, one (1) single stage TRIAC Output, and one (1) Dual Stage TRIAC Output
 5. Hardware Outputs shall be configured on hardware and/or in software and comply with the following:
 - a. Universal Outputs shall provide configurable modulating voltage signal to industry 0-5VDC and 0-10VDC analog control devices and relays
 - b. Each TRIAC Output shall source 500 mA current, 24 VAC 0.5 ACA
 - c. Universal Output shall be capable of sourcing 75mA at 12VDC
 - d. Outputs shall have a minimum 8 Bit D/A conversion resolution
 - e. 24VAC over-voltage and short protection
 6. Airflow Calibration, Test and Air Balance, etc. shall be performed via dedicated handheld configuration tool connected directly to communication port located at ATU B-ASC sensor] and/or [via the integral SS Flow Calibration interface of each space mounted SS. Special proprietary software and/or applications loaded on a computer or PDA shall not be acceptable to perform this function.
 7. B-ASC shall provide diagnostic LEDs for power, communications and processor status. The B-ASC shall continually check the status of its processor and memory circuits
 8. Controller wiring terminals shall be 5mm space between poles with removable terminal strips for ease of installation and service replacement
 9. B-ASC Enclosure shall be rated as follows:
 - a. NEMA 1
 - b. UL 94-5V
- L. B-ASC for unitary applications shall comply with the following:
1. B-ASC shall provide diagnostic LEDs for power, communications and processor status. The B-ASC shall continually check the status of its processor and memory circuits
 2. Controller wiring terminals shall be removable terminal strips for ease of installation and service replacement
 3. Universal field device hardware inputs shall be provided and configured on hardware and/or in software and comply with the following:

- a. Inputs shall accept dry-contact, thermistor, 4-20 mA, and 0-5VDC
 - b. Pulse accumulation shall accommodate a minimum frequency of 40Hz
 - c. Inputs shall have a minimum 10 Bit A/D conversion resolution
 - d. 24VAC over-voltage protection
4. Hardware outputs for field devices shall be provided as follows:
 - a. Four (4) Universal Outputs, or Four (4) TRIAC Outputs or One (1) Universal Output, one (1) single stage TRIAC Output, and two (2) Dual Stage TRIAC Output
5. Hardware Outputs shall be configured on hardware and/or in software and comply with the following:
 - a. Universal Outputs shall provide configurable modulating voltage signal to industry standard 0-5VDC and 0-10VDC analog control devices and relays
 - b. Each TRIAC Output shall source 500 mA current, 24 VAC 0.5 ACA
 - c. Universal Output shall be capable of sourcing 75mA at 12VDC
 - d. Outputs shall have a minimum 8 Bit D/A conversion resolution
 - e. 24VAC over-voltage and short protection

M. Control System Application Software:

1. The B-ASC application software shall be the same as and indistinguishable from the B-BC specified interaction with the Control System Application Software.
2. The controller software shall reside in a real time, multi-tasking, networking operating environment. Database definition shall be accomplished through the B-OWS online with the B-ASC. The complete database and application program shall reside in the B-ASC. The System Contractor shall configure the software to attain the proper sequence of control and to accomplish all other control system functions indicated in the Contract Documents.
3. The user shall be able to add, delete, or modify objects on-line as required. The programming shall provide all the necessary mathematics, logic, utility and control functions necessary for proper sequence of control.

N. Communications and Protocols

1. The B-ASC shall communicate with field devices and controllers on the BLCN using the BACnet physical data link MS/TP at 76.8 Kbps where not limited by third party devices such as variable speed drives, utility meters, etc..
2. The B-ASC shall provide a communications port for connection of the Portable Operators Terminal using Point-to-Point BACnet physical data link layer protocol or a connection to the inter-network.
3. B-ASC shall support and be capable of monitoring and controlling a network of a minimum of four (4) communicating remote space sensors, each with capability of a local LCD Display, adjustable set-point, and outputs for zone controls. These networked sensors shall not consume input/output hardware points in the B-ASC.
4. B-ASC shall support, transmit, and receive of segmented messages.

2.8 NETWORKED COMMUNICATING SPACE SENSORS

- A. Wall-Mounted Networked Communicating Space Sensors (SS) on a daisy-chained network are not allowed, each SS must occupy a hardware point.
- B. Each SS shall provide a Liquid Crystal Display (LCD), where indicated on the drawings, with the following minimum features:
 - 1. 36mm x 36mm (1.4" x 1.4") display area
 - 2. Display four (4) 0.6" digits and six (6) 0.3" characters simultaneously
 - 3. Capable of displaying icons, time, analog, and digital engineering units
 - 4. Programmable to display up to ten (10) data points in any combination of local and/or networked values from any device on the internetwork
- C. Each SS shall provide a local keypad for local user interface to perform navigation and adjustment of points configured as adjustable.
- D. Each SS shall provide a point of access for a B-OWS, Service Tool, etc. to the BACnet internetwork via the SS communication network.
- E. Where indicated on the drawings each SS shall provide at a minimum the following on-board integral I/O without the consumption of any inputs and/or outputs at the host DDC controller:
 - 1. Temperature sensor (local or remote)
 - a. 10k Thermistor
 - b. 12 Bit A/D Conversion
 - c. 0°C to 40°C (32°F to 104°F) range d. +/- 0.1°C (+/- 0.18°F) resolution
 - d. User calibrated +/- 0.1°C (+/- 0.18°F)
 - 2. Relative Humidity (RH)
 - a. 10% – 90% range
 - b. 0.1% resolution
 - c. +/- 2% accuracy
 - d. Replaceable sensing element
 - e. User calibrated
 - 3. Occupancy
 - a. Passive Infrared Radiation (PIR)
 - b. 5m/16.4" detection distance
 - c. 100° horizontal / 82° vertical detection
 - d. 64 detection zones
 - 4. Additional Space/Zone I/O
 - a. Two (2) thermistor or dry-contact inputs
 - b. Two (2) TRIAC Outputs (24VAC @ 0.5A)

2.9 TEMPERATURE CONTROL PANELS (TCP), ENCLOSURES & SUB-PANELS

- A. Provide pedestal base or wall mounted local control enclosure to house all control components associated with each area, system or mechanical equipment room
 - 1. The enclosures shall be minimum 16 gauge steel or aluminum, totally enclosed on all sides and painted with a baked enamel finish. All enclosures must maintain a minimum separation of 1" from the back wall.
 - 2. Enclosures located in wet indoor conditions or located outdoors shall meet NEMA 4X.
 - 3. Penetrations are permitted on bottom of enclosure only. Do not make conduit penetrations in top or side of enclosure. Each enclosure shall be equipped with a wire gutter below with a minimum of six ¾" minimum conduit penetrations into the bottom of the enclosure to accommodate system wiring.
 - 4. Where required by AHJ, enclosures located in mechanical or electrical rooms shall meet NEMA 2 requirements
 - 5. Enclosures located in all other locations including but not limited to mechanical or electrical rooms not requiring NEMA 2, occupied spaces, above ceilings and plenums shall be the same NEMA classification as all other enclosures located in the same environment, except if location requires additional protection due to potential vandalism or environmental conditions and shall at a minimum meet NEMA 1 requirements
 - 6. Enclosures provided as an integral (pre-packaged) part of another product and/or piece of equipment are acceptable
 - 7. Provide a continuous piano hinged door, keyed locking latch, and removable sub-panel. A single key shall be common to all control enclosures.
- B. Provide each DDC panel with a line filter, surge suppressor, electrical disconnect, control fuse, and control transformer. All sized and provided by the control system contractor.
- C. Provide power supplies located inside control enclosures shall be fully enclosed with external 24 Vac terminals, on/off control, equipment overcurrent protection, power indication, high/low voltage separation, and convenience 120VAC outlets.
- D. Provide insulated, modular, feed-through, clamp-style terminal blocks suitable for rail-mounting with end plates and partitions for the termination of all field wiring in control enclosures. Field wiring to equipment with integral terminals and/or unitary equipment (i.e., VAV ATU"s, EF"s, &c.) shall not be required to have terminal blocks.
- E. Rail mounted terminal blocks shall be color coded to match the associated conductor colors adhering to the standard wire recognition coloring scheme as scheduled in section 2.11.

2.10 INTERCONNECTING WIRE & CABLE

- A. All wiring regardless of service and/or voltage shall comply with the Contract Document [\[Division 16\]](#) [\[Section 26\]](#) Project Electrical System Specifications, the

National Electric Code (NEC), and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

- B. Where required all wiring regardless of service and/or voltage shall be in conduit in accordance with [\[Division 16\]](#) [\[Section 26\]](#) "Raceways and Boxes for Electrical Systems" and "Cable Trays for Electrical Systems" and shall be routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.
- C. Where permitted by all applicable specifications, local codes, NEC and AHJ; plenum-rated control cabling may be used where final application will be concealed but accessible. Where plenum-rated cable is allowed, it shall be routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.

2.11 GENERAL FIELD DEVICES

- A. All control relays shall be UL listed with contacts and coils rated for the application
 - 1. Relays used for in-line control start/stop of line voltage motors and shall have a current rating at least 150% full load amps.
- B. Control transformers shall be CSA and UL listed. Primary and secondary sides shall be fused in accordance with the NEC or shall be class 2 current limiting type. Transformers shall be sized such that the connected load is not greater than 80% of the transformer rated capacity.
- C. Voltage/Current to Pneumatic Transducer shall be non-bleed type 0-5V or 0-10V input and output pressure to match spring range of controlled device.
- D. Emergency shut-off switches shall be heavy duty, two-position push-pull, maintained contact, and illuminated 1-3/8 inch in diameter mushroom style push button switch. Provide hinged easy open protective clear cover to prevent accidental operation of switch.

2.12 ANALOG SENSORS

- A. Temperature Sensors: Temperature sensors are required leaving each element designed to change or vary a given supply temperature.
 - 1. Temperature sensors shall be linear precision element Thermistor type.
 - 2. Single point duct temperature sensor shall consist of 316 stainless steel or platinum sensing element, junction box for wiring connections and gasket to prevent air leakage and vibration noise.
 - 3. Averaging duct temperature sensor shall consist of a copper or stainless steel averaging element, junction box for wiring connections and gasket to prevent air leakage or vibration noise.
 - 4. Liquid immersion temperature sensor shall include thermowell, sensor and connection head for wiring connections.

5. Outside air temperature sensor shall consist of a single device sensor, ventilated non-metallic sun shield, utility box for terminations, and watertight gasket to prevent water seepage.
6. Space temperature sensor shall consist of an element within a ventilated cover. Sensors located in mechanical areas, plenums, lobbies, or other public spaces shall be simple sensor with no setpoint adjustment.
 - a. Terminal Unit space temperature sensors shall be provided in accordance with the drawings at the locations indicated with the following options as indicated on drawings:
 - 1) Standard Wall-Mount Space Sensor
 - 2) Setpoint Adjustment Buttons ("+" & "-")
 - 3) Override/Bypass
 - 4) Occupancy
 - 5) CO2
 - 6) RH
 - 7) Network Jack
 - b. All sensors not located in public spaces and associated with B-ASC or B-AAC that is located in normally inaccessible locations shall be the same.
 - c. Sensors shall be manually calibrated on site so that the wiring length does not detract from the sensor accuracy specified.
7. Where necessary due to structural cavities, masonry walls, proximity to exterior openings, and unconditioned spaces an insulated mounting base shall prevent temperature of mounting location from affecting sensor temperature reading.
8. Sensor guards shall protect sensor from damage in all public areas such as gymnasiums, classrooms, vestibules, restrooms, and corridors or as indicated at locations on the drawings.
9. Provide brass or stainless steel thermowells for each immersion type temperature sensor and switch.
- B. Wet Bulb temperature and humidity station shall be suitable for duct or outside mounting and consist of sensors, ventilated non-metallic sun shield, utility box for terminations, and watertight gasket to prevent water seepage.
- C. Pressure
 1. Static Air Pressure Sensor shall have linear output voltage signal. Zero and span shall be field-adjustable. Tubing shall be connected to a Pitot tube or other pressure/airflow sensing device. Under no circumstances shall tubing pass through equipment housing or ductwork.
 2. Pitot tube probe shall be at least 4 inches allowing for internal duct insulation.
 3. Steam and water gauge pressure sensor shall include connections secured to a stainless steel diaphragm sensor with a gasketed, dust and watertight housing for remote mounting.
 - a. All steam devices and sensors shall incorporate a "pig-tail" in installation

4. The differential pressure sensor for air applications shall provide a linear output voltage signal. The device shall be capable of over-pressurization to 10 PSI without a zero-shift and shall have a field adjustable zero and span. The assembly shall consist of pressure connections that secure pressure sensor to a housing for duct or remote mounting.
5. Differential Pressure Sensor for water shall consist of a differential pressure tap secured to a stainless steel diaphragm and an electronic sensor enclosed in a gasketed, dust and watertight case.
6. Five-valve manifold assembly shall be required to allow isolation and bypass of operating pressures from differential pressure sensor.
7. Snubbers shall be required to prevent system pressure hammers and surges from being fully transmitted to the pressure sensor.

D. Position

1. Damper Position indication consists of a potentiometer mounted in housing.
 - a. Damper Position End Switches shall employ mechanical position proving. Mercury style end switches shall not be accepted.
2. Control valve Position indicator consists of a potentiometer mounted on the valve actuator.
3. Float type level switch with SPDT snap acting contacts. Electronics shall be housed in a watertight enclosure.
4. Proximity Limit Switch shall be oil-tight, roller type, SPDT snap-acting switch with adjustable trim arm.

E. Flow

1. Electronic Air Flow Monitoring System (Type II): Other installations: Airflow monitoring systems shall be a solid state electronic device comprised of a thermistor based sensing grid and microprocessor based electronics panel for flow averaging, temperature compensation and signal transmission. [Ebtron,] [Paragon,] [Tek-Air] or [Air Monitor].
2. Water Flow In-Line Type: (For Pipe Sizes up to 1 ½ inches): In-line type flow sensor shall have a nonmagnetic spinning impeller. Sensor shall be Data Industrial Model 250B or equal.
3. Water Flow Insertion Type: (For Pipe Sizes 1 ½ inch to 10 inches): Provide a probe-mounted insertion type turbine sensor.
4. Indoor Air Quality Sensors shall measure both VOCs and CO2 in PPM. Sensors shall be mounted as indicated on the drawings.
5. Carbon Monoxide detection, where required on the contract drawings shall be a single or multi-channel, dual-level detectors, using solid-state sensors with 3-year minimum life, maximum 15-minute sensor replacement, suitable over a temperature range of 23°F to 130°F, calibrated for 50 and 100 ppm, with maximum 120-second response time to 100-ppm carbon monoxide.
6. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23°F to 130°F (-5°C to

55° C) and calibrated for 0% to 2% of full range, with continuous or averaged reading, 4- to 20-mA output for wall mounting.

7. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.
8. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing; suitable over a temperature range of -32°F to 1100°F (0°C to 593°C) and calibrated for 0% to 5%, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

2.13 SWITCHING SENSORS/THERMOSTATS

A. Temperature Thermostats

1. Provide one (1) Low Limit thermostat for each 20 sq/ft of coil face. Low limit thermostat shall be of the vapor pressure remote element, manual reset type with adjustable set point. The device shall respond to the lowest temperature to which any 1 foot of the element is exposed. Capillary sensing tubing serpentine vertically across the discharge face of the coil, and be supported firmly by mechanical clips.
 - a. Low Limit thermostats shall be DPDT with a minimum of one (1) NO contact and one
 - 1) NC contact
2. High limit thermostat shall be manual reset type. Sensing element shall be bimetal.
3. Capillary Type Thermostats shall have liquid or vapor-filled thermal system consisting of stainless steel or copper sensing element, connected to a fully compensating capillary tube, and operating bellows or spiral.
4. Surface Mounted Thermostats shall be line voltage on-off type suitable for strapped mounting to pipe.
5. Wall Mounted Thermostats shall be line voltage on-off type suitable for wall mounting.

2.14 AUTOMATIC CONTROL DAMPERS

- A. All Automatic Control Dampers provided as a part of this Specification shall bear the AMCA Seal as an indication that they comply with all requirements of the AMCA Certified Ratings Programs.
- B. A single damper section shall have blades that do not exceed 48" in length and shall be no higher than 72". Damper blades shall not exceed 8" in width. Applications requiring larger dampers shall be achieved by combining single damper sections.

- C. Frame construction shall be a minimum of #14 gauge galvanized steel formed into channels and welded, 14 gauge galvanized roll-formed steel or extruded aluminum at a minimum 4½" by 1" by 0.125" thick.
- D. Blades and baffles shall be fabricated of minimum 16 gauge steel with corrosion resistant galvanized finish or extruded aluminum 6" by 0.08".
- E. All dampers shall be provided with nylon, cyclopy or oilite bearings, stainless steel or elastomeric side seals, and zinc plated hardware as standard.
- F. Axles shall be a minimum of ½" diameter and be locked to blade with rivets or welded.
- G. Dampers shall be made up of 6" or 8" blades or combination of the two. Dampers shall have a minimum of four brakes running the entire length. Silicone or polyurethane blade edging shall be furnished on all dampers.
- H. Maximum leakage rate through any 48 inches by 48 inches closed damper in any application shall not exceed 10.0 cfm per sq. ft. of damper face area at 4 inches of water pressure differential and a maximum closing torque of 4 inch-lbs./sq. ft. of damper face area. Damper leakage ratings shall be certified in accordance with AMCA Standard 500-D.
- I. Blades mounted vertically shall be supported by thrust bearings
- J. All Automatic Control Dampers in modulating applications shall be sized so as to achieve linear airflow characteristics
- K. Flow Control Application Dampers (Opposed Blade Operational Style)
 - 1. Opposed Blade Automatic Flow Control Dampers shall be required as indicated on the drawings for:
 - a. All mixing, volume throttling, airflow control, &c. applications installed in Outdoor, Relief, Exhaust, and/or Supply airstreams.
 - b. Any application upstream of critical components
 - c. Ducted Outlets
 - d. Automatic Flow Control Dampers specifically indicated to be provided by Mechanical Equipment manufacturer and/or as a component of packaged equipment shall not be provided by the Contractor.
 - 2. To minimize leakage, blade edges shall be interlocked and blade seals shall be compressible at all contact points. Channel frames shall also be provided with jamb seals.
 - 3. All Outdoor Air Damper components shall be suitable for applications operating in the temperature range of -40°F (-4°C) to 167°F (75°C)
 - 4. Damper shall be rated for a minimum velocity of 2000 ft/min
- L. Mechanical Ventilation, Miscellaneous Utility Dampers (Parallel Blade Operational Style)

1. Parallel Blade Automatic Flow Control Dampers shall be permitted as indicated on the drawings for applications not requiring Opposed Blade operation pursuant with that specification section and for:
 - a. Two-position (fully-open or fully-closed) applications
 - b. Applications where the damper constitutes the primary source of total system pressure loss
 - c. Applications where greater control is required at the upper end of airstream volume operating range
 - d. Mechanical Space ventilation and exhaust, combustion intake & exhaust, &c.
2. Shall comply with AMCA 500-D Class 4 and shall not leak in excess of 80cfm per sq/ft at 4inwc static pressure when closed.
3. Damper shall be rated for a minimum velocity of 1500 ft/min

M. Operating Linkages and Damper Accessories

1. All operating linkages and/or damper accessories required for installation and application in accordance with specification design intent and manufacturer's installation procedures shall be provided
2. Operating linkages provided external to dampers (crank arms, connecting rods, shaft extensions, &c.) for transmitting motion from the actuator/operator to dampers shall be designed as to functionally operate a load equal to or in excess of 300% of the maximum required operating force for the damper.
3. Crank arms and connecting rods shall be adjustable. Linkages shall be brass, bronze, zinc- coated steel, or stainless steel.
4. Adjustments of Crank Arms shall control the position of the damper
5. Use of Operating Linkages external to damper drive shaft shall neither delay nor impede operation of the damper in a manner of performance less than a direct-coupled damper actuator. Operating linkages shall not under any circumstances be permitted to flex, warp, shift &c. under normal operation of connected damper sections.

2.15 AUTOMATIC CONTROL DAMPER ACTUATORS: Belimo is a preferred product

- A. Control damper actuators shall be electronic direct-coupled type. Actuators shall have a means for reversing drive direction and a manual override accessible at the front cover.
- B. Single bolt or setscrew type fasteners are not acceptable.
- C. The actuator shall have electronic overload or digital rotation sensing circuitry. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
- D. For spring return fail-safe applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.

- E. All non-spring return actuators shall have an external manual clutch/gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-LB torque capacity shall have a manual crank for this purpose.

PART 3 - EXECUTION

3.1 GENERAL

- A. BAS component locations are the responsibility of the System Contractor. All control system components shall be installed in locations as required to properly sense the controlled medium.
- B. BAS Installation shall be performed by professionals in a workmanlike manner and in compliance with the Contract Documents, [Division 16] [Section 26] Project Electrical System Specifications, the National Electric Code (NEC), and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ) and the following:
 - 1. Complete BAS installation including all DDC Devices, Enclosures, wiring, equipment, control devices and sensors shall be installed in accordance with the manufacturers' recommended installation procedures and as specified.
 - 2. All control devices are to be provided and installed with all required gaskets, seals, flanges, connection enclosures, thermal compounds, insulation, piping, fittings, and valves as required for design operation, isolation, equalization, purging and calibration.
 - 3. Strap-on control devices shall not be permitted except as explicitly called out
 - 4. All control devices mounted outdoors shall be protected by a weather-shield, integral outdoor enclosure, &c. from ambient elements in such a manner as to not impede design functionality and/or sensing
 - 5. BAS installation shall be such that it provides sufficient clearance for system maintenance by maintaining sufficient access for equipment, device and/or component service, calibration, removal, repair, or replacement.
 - 6. BAS installation shall not interfere with required clearance for mechanical and/or electrical equipment maintenance.
 - 7. Penetrations through and mounting holes in the building exterior associated with the BAS installation shall be sealed and made water-tight
 - 8. Dielectric isolation shall be provided where dissimilar metals are used in installation for connection and support
 - 9. Installation, wiring and material shall be protected from damage by and during BAS installation by BAS Contractor,
- C. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed.
- D. After completion of installation, calibrate and commission all components provided as part of the Control System and demonstrate proper sequence of operation in

compliance with the specifications. BAS components not operating correctly shall be field corrected or replaced.

3.2 DIRECT AND WEB-ENABLED BAS APPLICATION SOFTWARE

- A. At time of acceptance all operating system, Third party and Control System Application software shall be at least the latest official release version available.
- B. Software programs are described to their general intent. It is recognized that Networked System manufacturer's software differ; however, the Application software provided shall incorporate the features described fully implemented and optimized to provide the sequences described, minimize energy consumption, and prolong equipment life.
- C. The following standard naming convention shall be utilized for the naming of BACnet Devices on the BACnet internetwork.
 - 1. The convention for object names must adhere to the standards set by the owner's representative.
- D. When programming the system BACnet addressing rules will be strictly adhered to. All addressing strategies will have to be approved by the owner's representative prior to configuring any LAN types.
- E. All analog and binary values shall be programmed with appropriate alarms.
- F. Except as specified otherwise, throttling ranges, proportional bands, and switching differentials shall be centered on the associated set point.
- G. All set points unless otherwise indicated are adjustable and shall be programmable for all control loops.
- H. Each control loop and/or interlock(s) for all mechanical system including terminal unit systems shall be programmed with a control loop specific graphical trend to trend all values associated with each specific control loop or system interlock.
- I. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the system start commands shall be staggered by 60-second (adj.) intervals to minimize inrush current.
- J. Scheduling shall be developed for each mechanical system. Final schedules shall be coordinated with the owner's representative prior to system commissioning. Until indicated otherwise the following schedule shall be used:
 - 1. Occupied: Monday – Friday/07:00 – 20:00
 - 2. Unoccupied: All other times and all statutory holidays.
- K. Optimal start/stop programs shall be applied to all regularly scheduled mechanical and electrical systems.

- L. At a minimum, trend log/historical data shall be implemented for every hardware point on the system. Additionally all software (virtual) points used as setpoints shall be trended. Point trends shall be grouped into logically interrelated points for individual mechanical and building systems. Initial set-up shall be to log values once every 5 minutes. Refer to points list on electrical and mechanical drawings for components requirements.
- M. B-OWS Graphical User Interface (GUI) must be approved by the owner's representative and shall incorporate at a minimum the following:
 - 1. At a minimum, all physical hardware, sensors, control devices and set points shall be visible on a B-OWS in graphical form.
 - 2. All mechanical systems shall have a programmed real time color graphic for primary graphical user interface
 - 3. Individual floor plan graphics will be programmed for each floor or area of the building. All space sensors will be visible on floor plan graphics and system graphic.
- N. The system shall observe the following command priorities (from highest to lowest):
 - 1. Smoke Control and Life Safety (BACnet Object Priority Array Level 1 & 2)
 - 2. Manual Operator Command (BACnet Object Priority Array Level 8)
 - 3. Energy Management (BACnet Object Priority Array Level 9)
 - 4. Normal Automatic Control (BACnet Object Priority Array Level 10)

3.3 DIRECT AND WEB-ENABLED SERVER, (B-OWS) HARDWARE

- A. Provide as specified for each PC-Based B-OWS
- B. Assemble server components in a configuration that allows easy operator access to all necessary components from one position. Locate components as required by the owner's representative.
- C. Connect to LAN as required. If LAN/WAN is not dedicated to the BACnet network then Contractor shall develop a LAN/WAN System Architecture diagram denoting server B-OWS relative to other nodes on its segment of the LAN/WAN. This diagram shall be submitted at a minimum as a part of the As-Built and O&M Documentation.
- D. Provide sufficient permanent and removable storage drives for 25% free memory after provision for all operating system, Third party and Control System Application software, all fully configured point databases, storage/back-up of all B-BC, B-AAC and B-ASC application programming, all graphic files, all user-defined reports and a three year archive of all trend and historical data described in this specification.
- E. Provide sufficient RAM to meet system performance requirements.

3.4 LOCAL AREA NETWORKS (LAN)

- A. The control system shall be configured so that any individual network shall not exceed 80% of its total design network capacity. The system shall have a reserve of 20% network capacity.
- B. Where possible all Hubs, Switches, Half and Full Routers will be from the same manufacturer. Switches will be all "Store and Forward" type and will be installed in accordance with manufacturer specifications.
- C. Inverted Networks will not be allowed. Networks with minimum packet sizes smaller than those it connects to will not interconnect networks with larger minimum packet sizes. If three or more networks are interconnected the network with the highest speed and minimum packet size will be utilized to interconnect the slower networks.
- D. Where BACnet/IP LAN type is used, non-TCP/IP devices shall not be used. Where BACnet/IP is provided it shall comply with all Addendum to ANSI/ASHRAE 135-1995 BACnet/IP.

3.5 BACnet PROTOCOL VERIFICATION SOFTWARE

- A. Demonstrate exclusive communication utilizing the BACnet Protocol on all segments of the BACnet network.

3.6 BUILDING CONTROLLER (B-BC)

- A. Provide as required to meet performance requirements of the system with a 20% increase in connected B-AAC and B-ASC on any individual network. Provide a dedicated B-BC for all project specific equipment requiring this controller type.
- B. Locate strategically such that B-BC locations are as equally distributed throughout the project as possible.

3.7 ADVANCED APPLICATION CONTROLLERS (B-AAC)

- A. Provide a dedicated B-AAC for each medium-sized mechanical system.
- B. All points used for a single mechanical system shall be connected to the same B-AAC. Points used for control loop reset based on outside air, or space/zone temperature, or extremely remote differential pressure sensors on slow acting control loops are exempt from this requirement.
- C. Provide spare additional I/O such that future use of spare capacity shall require providing only the field device, field wiring, point database definition and operational sequence programming changes as required. Additional point modules may be required to implement use of these spare points.

1. Provide at least one (1) spare universal input and one (1) spare universal output or 15% spare I/O of the total capacity of each B-AAC whichever is greater.
2. If B-AAC I/O is not universal then provide at least one (1) spare analog input, one (1) spare digital input, one (1) spare analog output and one (1) spare digital output or 15% spare I/O of the total capacity for each point type of each B-AAC whichever is greater.

3.8 APPLICATION SPECIFIC CONTROLLERS (B-ASC)

- A. Provide a dedicated B-ASC for each Terminal Unit Mechanical Device on the project, including VAV and Fan Powered Terminal Units, Unit Heaters, and Individual Fans. Terminal Units specifically called out in the sequence of operation, as "Non-DDC" shall be excluded from this requirement.
- B. All points used for a single Terminal Unit Mechanical Device shall be connected to a dedicated B-ASC. Points used for control loop reset based on outside air, or space/zone temperature, or extremely remote differential pressure sensors on slow acting control loops are exempt from this requirement.

3.9 LOCAL SYSTEM NETWORK INTERFACE

- A. At a minimum, the Portable B-OWS shall be able to connect to the BACnet Internetwork within each mechanical equipment space within the project. For manufacturers systems that do not allow direct portable B-OWS connections to B-AAC and B-ASC this may require that a higher level LAN be routed to each mechanical equipment space with a jack.

3.10 TEMPERATURE CONTROL PANELS (TCP), ENCLOSURES & SUB-PANELS

- A. All system components not designed for or required to be field installed shall be mounted in a control enclosure. Those components shall be sub panel mounted except components that are mounted on the panel face. Provide on/off power switch with over-current protection for control power sources in each local enclosure.
- B. All control enclosures shall be located as shown on the drawings and wherever possible (or where not indicated on the drawings) so that visual observation and adjustment can be accomplished while standing flatfooted on the floor in a convenient location adjacent to the equipment served. Install all equipment in readily accessible location as defined by Chapter1 Article 100 Part A of the NEC.
- C. Label all control system components.
- D. A copy of the "As-built" application engineering for the system served shall be laminated in clear plastic, shall be legible and suspended within enclosure.
- E. All B-BC shall be mounted in an enclosure.

3.11 INTERCONNECTING WIRING AND CABLING

A. General

1. It shall be the System Contractor's responsibility to provide all wiring required for a complete Control System.
2. Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with the Contract Documents, [\[Division 16\]](#) [\[Section 26\]](#) Project Electrical System Specifications, the National Electric Code (NEC), and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ) and shall include but may not be limited to the following:
 - a. All power wiring required not indicated on the electrical plans and specifications.
 - b. Power to all actuators and sensors.
 - c. Provide all wiring and cabling for network communications except for owner provided LAN"s/WAN"s.
 - d. All sensor and control device input and output wiring.
 - e. All interconnecting cabling between and amongst network devices, PCs printers, modems, etc.
 - f. Interlock wiring between devices, and between motor starters.
 - g. All other necessary wiring for fully complete and functional system as specified.
 - h. Install piping, wiring/cabling routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.
3. Maximum allowable voltage for control wiring shall be 120-volts.
4. All wiring shall be installed as continuous links. Any required splices shall be made only within an approved junction box or other approved protective device with a maximum fill of 50%.
 - a. BACnet network cabling shall not be field spliced
5. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
6. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

B. Power Wiring and Cabling

1. Where required, power wiring for the control system shall be from circuits on emergency power panels. At a minimum; B-BC"s, the B-OWS and any other DDC devices and control devices connected to and/or responsible for system critical equipment shall be powered from circuits on emergency power panels.
2. Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications to be provided under

[Division 16] [Section 26]. Dedicated branch circuits shall be provided under [Division 16] [Section 26].

3. All B-OWS equipment shall be served from isolated ground receptacles via UPS by dedicated branch circuits.
4. All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.

C. Network Wiring and Cabling

1. Network installation shall strictly adhere to the manufacturer's networking installation instructions and procedures
2. All communications wire shall be externally identified as "Building Energy Management System Network" at least once every five feet.
3. Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135-1995, BACnet will be followed. Those include but are not limited to:
 - a. Only one path can exist from any BACnet device to another
 - b. Each BACnet device connected to an internetwork LAN must have a unique device instance (0 - 4,194,303).
 - c. Each internetwork LAN must have a unique Network Number (1 - 65,545).
 - d. Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot, and preferred 22AWG or lower. A shield wire shall be included for ground connection.
4. Primary LAN Network wire and cable shall be run separately from all other wiring.
5. Other LAN Network wire and cabling shall be installed separate from any wiring over thirty
6. (30) volts.
7. All communications shielding shall be grounded as per Networked System manufacturer's recommendations.

D. Installation

1. Except in mechanical and electrical spaces where other conduits or piping is exposed, conceal wiring and cabling as much as possible and install and comply with the requirements of the Contract Documents, [Division 16] [Section 26] Project Electrical System Specifications, the National Electric Code (NEC), and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ)
2. All wiring and cabling installed in and/or routed through TCP, Enclosures and Sub-Panels shall regardless of voltage and/or service be fastened securely using cable ties, non-metallic wiring duct and/or other standard industry wiring management means and methods in a workmanlike manner parallel and/or perpendicular with enclosure.
3. All TCP, Enclosures, Sub-Panels, Junction Boxes, Pull Boxes, Troughs, Trays, Raceways, Conduits, &c. shall not exceed 70% maximum conductor fill.
4. Each Input/Output device shall be controlled from a dedicated 2-pair conductor

5. Each Input/Output device requiring power shall have a dedicated power wire run to the control enclosure and shall be terminated to a dedicated terminal strip
6. All wire with controls enclosure shall be neat and suitably bundled and contained in Panduit wire duct or equivalent
7. All wiring will be suitably identified by thermal print heat shrink tubing at controller and Input/Output device.

3.12 ANALOG SENSORS

A. Temperature

1. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
2. Install and properly support all enclosures and sensing elements as much as possible in the center of duct cross section and in straight duct runs. In condensing environments use stainless steel flanges to support sensing elements.
3. Sensors mounted on air ducts having exterior insulation shall be provided with handy-box mounting with insulating material firmly fitted around handy-box.
4. Sensors for mixed air and outdoor air streams greater than 6 square feet or 24" in either direction shall be averaging type. Provide a minimum of 1 linear foot of sensor per 4 square feet of duct area or equal to duct width where installed, whichever is longer. Averaging sensing tubing shall serpentine vertically across airstream and be supported firmly by mechanical clips.
5. Temperature sensors installed in piping or tanks shall be in separable thermowells. Sensors shall be inserted into thermowells with conductive paste. Assembly shall allow removal of sensor without loss of fluid.
6. At a minimum one outside air temperature sensor shall be installed. It shall be mounted outside on a northern exposure as high as serviceable on the building. The sensor shall be mounted within a ventilated enclosure to shield the sensor from the effects of the sun. The sensor location shall be selected such that it may not be affected by artificial and/or mechanical airstreams (i.e., building exhaust, building relief, &c.).
7. Terminal Unit Sensors shall be provided one per terminal unit device with the exception of large non-partitioned areas served by multiple terminal units.
 - a. They shall be wall mounted in the space served 60" above finished floor and located as shown on drawings.
 - b. Provide a minimum of 16" of coiled temperature sensor control wiring for equipment with space sensor not located on the Drawings.
 - c. In all areas where terminal unit sensor locations are not known at the time of building startup, sensors shall be hung approximately 24 inches from the ceiling in the area of the controlled zone and connected. Control wiring shall be neatly coiled and attached to ceiling grid. Sensors located in service corridors where subject to regular damage shall be mounted 84" above finished floor.

8. Zone temperature sensors shall not be located on perimeter walls. Where explicitly indicated on drawings to do so and/or in locations near exterior walls and/or subject to drafts sensors shall have insulated mounting bases to prevent false room temperature readings.
9. Where wall sensors are mounted in an area subject to damage provide suitable protective guard.
10. Where wall sensors are mounted in public spaces with adjustable set points provide suitable security guard.
11. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1°C (0.2°F).

B. Wet Bulb

1. For outside air mount same as outside air temperature sensor.
2. For duct mounting execute same as duct mounted temperature sensor.

C. Pressure

1. Orient static pressure sensing taps faced directly down-stream in the airflow so as to eliminate velocity pressure effects. Locate pressure transducers within 50" of sensing point and use tubing sized such as to prevent signal phase lag.
 - a. Final location of static/differential pressure sensing taps shall be pursuant with Contract Documents and as indicated on drawings. Where not explicitly indicated on drawings, pressure sensing taps shall be located as follows:
 - 1) Duct static pressure control sensor tap shall be located 2/3 distance from the Air Handling Unit of the total duct length in a straight section of ductwork with a minimum of four (4) duct diameters in both directions
 - 2) Positive static high-pressure safety cut-outs shall be located at Air Handling Unit immediately downstream of fan section
 - 3) Mixed-Air static and/or differential sensor tap shall be located in mixing box section
 - 4) Negative static pressure safety cut-outs shall be located immediately upstream of fan section
 - 5) Filter differential pressure taps shall be installed on both filter inlet and outlet
 - b. Mount air differential pressure taps so that true differential is sensed
2. Water gauge taps shall include snubbers and isolation valves
3. Water differential pressure sensors shall be piped through a five-valve bypass assembly with snubbers

D. Position

1. Mount damper position indicator onto damper blade and out of air stream as much as possible.

E. Flow

1. Mount airflow measuring station differential pressure sensor outside of fan casing.

3.13 SWITCHING SENSORS

A. Temperature

1. Wherever mixed or entering air temperatures are below 35°F (1.4°C), the sensing tube shall be installed across the leaving face of the first coil in the airstream. The low-temperature thermostat shall be arranged to stop the units supply fan and its associated return air fan should the temperature at any point along the sensing element fall below 35°F (1.4°C). Provide a minimum of one foot of sensing element for each square foot of coil face area. In condensing environments use stainless steel sensing element and capillary mounting clips.

B. Differential Pressure

1. Differential pressure type switches shall be installed as per differential pressure sensors and shall provide a maximum switching differential of 10% of the sensed operating range for the application at minimum and maximum designed flow rates. Set point shall be selected to operate at midpoint of span.
2. Paddle type water flow switch shall be used to verify flow through chillers, other applications for operational, safety or other critical control interlock, on-off flow status monitoring, and at locations as indicated on the Drawings. Provide with NEMA 4 enclosure when installed in a condensing environment.
3. Differential pressure type water flow switch shall be used for on-off flow status monitoring of equipment and to position secondary chilled water loop return control valves. The sensing tubes shall be installed between the equipment and the nearest service valves.

C. Position

1. Mount damper blade end switch in such a manner that it is located out of the airstream as much as possible. End switch as installed shall be repeatable to within a range of 5 degrees. Under no circumstances shall mercury-style end switches be permitted.

- D. Direct drive motors are permitted to utilize a current switch without an adjustable set point.

3.14 DAMPER ACTUATORS

- A. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

- B. Spring return actuators shall be provided except as follows.
1. Terminal or unitary equipment without direct introduction of outside air are permitted to have actuators that maintain their last commanded position when power is lost.
 2. Damper actuator shall not be required to be provided with spring return provided that it is not directly connected to Outdoor Air and a failure of the damper to return to its "normal" position will not incur damage to the system/space it serves.
- C. Modulating actuators shall be provided for terminal unit mechanical devices may use an actuator that responds to a floating or tri-state signal.
- D. Minimum torque and power output requirements of actuators shall not be less than 1.2 times required design load.
- E. When an air handling unit or major piece of mechanical equipment is not in operation, control damper shall remain in their "off" positions. Fail-safe positions shall be the same and defined as follows

DEVICES	OFF/FAIL-SAFE POSITION
1. Outdoor Air Dampers:	Closed
2. Return Air Dampers:	Open
3. Exhaust/Relief Air Dampers:	Closed

END OF SECTION 13 85 00