

**PUBLIC WORKS PROJECT NUMBER: 84003001-22-058-C1
CLEAR CREEK WELCOME CENTER
WEST TERRE HAUTE, INDIANA / INDOT**

Volume 2 of 6

MARCH 2023

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PROJECT MANUAL

For construction of:

**Clear Creek Welcome Center
West Terre Haute, Indiana**

**Public Works Project
84003001-22-058-C1**

For

Department of Transportation

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C-900	SITE WATER LINE LAYOUT
C-901	SITE WATER LINE LAYOUT
C-902	WATER MAIN DETAILS

CS-100	INDOT STANDARD DRAWING
CS-101	INDOT STANDARD DRAWING
CS-102	INDOT STANDARD DRAWING
CS-103	INDOT STANDARD DRAWING
CS-104	INDOT STANDARD DRAWING
CS-105	INDOT STANDARD DRAWING
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CS-107	INDOT STANDARD DRAWING
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CS-165	INDOT STANDARD DRAWING
CS-166	INDOT STANDARD DRAWING
CS-167	INDOT STANDARD DRAWING
CS-168	INDOT STANDARD DRAWING

DRAWING SET #6 SANITARY

G100	TITLE SHEET
G101	INDEX
G102	PROJECT OVERVIEW
C101-C102	GRAVITY SANITARY SEWER PLAN & PROFILES
C103	LIFT STATION SITE PLAN
C104	LIFT STATION DETAILS
C201-C210	LINE "PR-FM » FORCE MAIN PLAN & PROFILES
C400-402	EROSION CONTROL
C500-502	CONSTRUCTION DETAILS

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All materials, equipment and labor required for formwork, reinforcing, placing, finishing and curing cast-in-place concrete.
- B. Installation of all specified items to be embedded in cast-in-place concrete.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Structural Steel - Section 05 12 00: Anchor rods, embed plates, and other items to be embedded in cast-in-place concrete.
- B. Miscellaneous Metals - Division 5

1.3 RELATED SECTIONS

- A. Polished Concrete Finishing – Section 033543
- B. Site Paving - Division 32

1.4 REFERENCES

- A. Work on this project shall conform to all requirements of the current version of the specifications listed below published by the current building codes except as modified by these contract documents.

ASTM specifications apply in their entirety where specifically referenced in the body of this section.

Refer to specific portions of other guides, guidelines, and manuals where referenced in the body of this specification section.

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials
2. ACI 301 - Specifications for Structural Concrete
3. ACI 305.1 - Specification for Hot Weather Concreting.
4. ACI 306.1 - Specification for Cold Weather Concreting.
5. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures.
6. ACI 318 - Building Code Requirements for Structural Concrete.
7. CRSI Manual of Standard Practice.

1.5 INFORMATIONAL SUBMITTALS: PLACEMENT RECORDS

- A. Concrete Placement Daily Records: Turn over to the Architect/ Engineer on a weekly basis.

1.6 ACTION SUBMITTALS

A. Concrete Mix Designs:

1. Submit for review a mix design for each class of concrete required for the project under the provisions of Division 1 and including:
 - a. Standard deviation analysis, required average strength and documentation of average strength verifying compliance with ACI 318.
 - b. Mix proportions by weight, water-cement ratio, slump and air content.
 - c. Sieve analyses of fine and coarse aggregates.
 - d. Complete list of materials specified in PART 2 - PRODUCTS - CONCRETE MATERIALS article with product information demonstrating compliance with all specified requirements.
2. Submit with sufficient time allowed for review before concrete is required for the project.

B. Reinforcement Shop Drawings:

1. Submit the proposed Shop Drawing Submittal Schedule prior to submitting any of the shop drawings for review.
2. Prepare shop drawings giving complete details of fabrication and placement.
3. Shop drawing action codes:
 - a. Shop drawings marked "Reviewed" do not require a resubmittal. Fabrication may commence.
 - b. Shop drawings marked "Reviewed with exceptions" require the marked corrections to be made. No resubmittal is required. Fabrication may commence leading to reinforcement installation once all exceptions noted are corrected.
 - c. Shop drawings marked "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may not commence.
 - d. Shop drawings marked both "Reviewed with Exceptions" and "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may commence. Installation may not begin until the subsequent submission has been reviewed and returned for use in reinforcement installation.
 - e. Shop drawings marked "Rejected" must be resubmitted prior to any further review being completed.

4. Shop Drawings will be checked by the Architect/Engineer for correct interpretation of the Drawings but this check shall not relieve the Contractor of their primary responsibility to provide the correct number of properly detailed bars in all members.
 5. Resubmitted shop drawings:
 - a. All information which is correct on the original submittal will not be changed in any way on the resubmitted shop drawings.
 - b. Cloud all information changed due to a Change Order.
 6. See the General Notes and Typical Details for additional reinforcing around openings and other general information for the Detailer.
 7. Prepare shop drawings in accordance with the following:
 - a. Provide bar bending diagrams for all bent bars within a submittal in that same submittal.
 - b. Sections of walls and slabs shall be provided showing clearly bar positions and clearances to forms.
 - c. On wall sections, indicate spacers used to maintain clearances for vertical wall steel.
 - d. Include all details, sections, and installation instructions indicated on the structural drawings that are required by the Contractor to place the reinforcement without using the structural drawings.
 - e. Indicate grades of reinforcement on each shop drawing.
 - f. For slabs, show support system in number and quantity. The maximum spacing of support bars shall be 4'-0". The maximum overhang beyond a support bar or a slab bolster shall be 1'-0".
 8. Submit the following regarding the dowel bar replacement system and any other accessories to be used:
 - a. Shop drawings indicating fabrication and placement details per this section.
 - b. Manufacturer's literature, product samples, and certified test reports substantiating compliance with the Specification.
- C. Product Information: Submit product information for review for materials specified in PART 2 - PRODUCTS article under the provisions of Division 1 and demonstrating compliance with specified requirements.

1.7 QUALITY ASSURANCE

- A. Provide at least one experienced person present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

- B. Perform work in accordance with ACI 301.
- C. Conduct field sampling and testing of concrete, including the making of test specimens, with personnel holding current certificates issued by the Concrete Technician Certification Committee of ACI.
- D. Field survey of cast in place embedments: Anchors rods, embed plates etc.
 - 1. Survey elevations and locations of anchor rods and embeds to receive structural steel, miscellaneous steel and cladding attachments. Survey is to be completed by a registered surveyor experienced in building construction in the state in which the project is located. Anchor rods not placed within the AISC 303 - Code of Standard Practice for Steel Buildings and Bridges (Article 7.5) shall be specifically noted in the field survey report. Survey shall be completed prior to fabrication of the base plates that accommodate the anchor rods.

1.8 DESIGN

- A. All formwork shall be designed by the Contractor who shall be solely responsible for this work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Reinforcement protection:
 - 1. Use all means necessary to protect concrete reinforcement before, during and after installation and to protect the installed work and materials of all other trades.
 - 2. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bondbreaking coatings.
 - 3. Use all necessary precautions to maintain identification after the bundles are broken.
 - 4. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.
- B. Deliver concrete in accordance with ASTM C94. Do not use non-agitating transporting equipment.
- C. Deliver materials and equipment in undamaged condition.
- D. Store materials and equipment in designated areas and in accordance with manufacturer's instructions.
- E. Store materials and equipment off the ground, totally protected from ground splash, mud, weather separation, intrusion of foreign materials, and other damage.

1.10 INCLEMENT WEATHER REQUIREMENTS

- A. Inclement Weather: Do not place concrete during rain, sleet or snow unless adequate protection is provided.
- B. Hot Weather: Perform work under provisions of PART 3 - EXECUTION - HOT WEATHER CONCRETING article.
- C. Cold Weather: Perform work under provisions of PART 3 - EXECUTION - COLD WEATHER CONCRETING article.

PART 2 - PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

A. Form Lumber:

- 1. One of the following or a combination thereof.
 - a. Forms for all concrete unless otherwise indicated:
 - 1) Face Forms: Rough sawn lumber, CDX plywood, particle board BBOES plywood, MDO plywood
 - b. Forms for as cast concrete surfaces to remain exposed to public view (Architectural Finish, per drawings):
 - 1) Face Forms: Unless noted otherwise, High Density Overlaid Plyform Class I or II, exterior, bearing APA grade stamp on each piece. Minimum thickness: 3/4".
 - 2) Phenolic surface film, plastic, or steel material where specifically noted.
- 2. Surfaces and lines for surfaces to remain exposed to public view (Architectural Finish, per drawings) shall comply with ACI 117 tolerances and form facing category compatible with concrete surface category per Table 3.1a, ACI 347.3R. Surfaces produced shall require only minor dressing to arrive at true surfaces.
- 3. All form lumber in contact with exposed concrete shall be new or of sufficient quality to ensure an unblemished texture.

B. Form Ties:

- 1. Factory fabricated, adjustable length, snap-off metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. The metal after breaking should be at least 1" from the face of the wall.

C. Form Release Agent:

1. Non-staining, neutral, barrier type which will not cause softening or impede curing.
2. Standards:
 - a. DUO guard Chemical Release Agent – WR Meadows
 - b. Magic Kote E Symons Manufacturing Company
 - c. Clean Strip J1EF Form Release by Dayton Superior.
3. Refer to Division 1 Sustainable Design specification section for any restrictions on form release agent materials that may override the above products.

D. All other materials, not specifically described but required for proper completion of concrete formwork, shall be as selected by the Contractor.

2.2 CONCRETE REINFORCEMENT

A. All concrete reinforcement materials shall comply with the following reference standards:

1. Reinforcing Bars: ASTM A615 Grade 60
2. Wire Reinforcement: ASTM A1064
3. Welded Wire Reinforcement: ASTM A1064

B. Accessories:

1. Provide bar supports, ties, blocking and accessories in accordance with CRSI "Manual of Standard Practice".
2. Use bar supports for slab on grade that do not puncture specified underslab vapor barrier.
3. Use precast concrete blocks for bar supports of footing/foundation reinforcing placed directly on subgrade.

C. Dowel bar replacement system:

1. Shall conform to ACI 318.
2. Standards:
 - a. DBDI Splice System-Dayton Superior Corporation
 - b. Lenton Form Saver - Erico Products, Inc.
 - c. BDI Bar Splicer System - Bar Splice Products, Inc.

D. Rebar anchorage system (mechanical bar terminators):

1. Shall conform to ACI 318.

2. This anchorage system shall be used only in places indicated on the structural drawings or in areas approved by the Structural Engineer.
3. Standards:
 - a. Lenton Terminator – Erico
 - b. MRC D-158 Structural Rebar End Anchor - Dayton Superior

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type III.
- B. Portland Limestone Cement: ASTM C595, Type IL.
- C. Flyash: ASTM C618, Class C or Class F.
 1. Maximum loss on ignition: 3.0 percent.
 2. Maximum amount retained when wet-sieved on No. 325 sieve: 30 percent.
 3. Flyash not permitted for concrete to be polished.
- D. Slag Cement: ASTM C989, Grade 100 or 120.
- E. Fine Aggregate: ASTM C33.
 1. Natural sand of clean, hard, durable particles.
 2. Sieve analysis to conform to the following gradation requirements:

Sieve Sizes	Percent Passing
3/8	100
No. 4	95-100
No. 6	--
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	5-30
No. 80	--
No. 100	0-10

- F. Coarse Aggregate: ASTM C33.
 1. 3/4" maximum aggregate size, Crushed stone or gravel of clean, sound, tough, durable particles.
 - a. For air-entrained concrete mixes: ASTM C33, Class 4S.
 - b. For non air-entrained concrete mixes: ASTM C33, Class 2S.
 - c. Sieve analysis to conform to the following gradation requirements:

Sieve Size Passing	Percent
1"	100
3/4"	75-95
1/2"	40-70
3/8"	20-50
No. 4	0-15
No. 8	0-10
No. 30	--
No. 200	--

G. Aggregate for concrete slabs to be polished: Provide aggregates from single source.

1. River Rock as approved by Architect
2. Maximum Coarse Aggregate Size: 3/4 inch nominal
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

H. Water: Clean and free from injurious amounts of oil, acids, alkalis, salts, organic materials and other deleterious substances.

I. Air-Entraining Admixture: ASTM C260.

1. Standards:
 - a. Master-Air AE 200 by Master Builders Solutions.
 - b. Master Air AE 90 by Master Builders Solutions.
 - c. Daravair Series by GCP Applied Technologies.
 - d. Air Mix by The Euclid Chemical Co.
 - e. AEA 92 by The Euclid Chemical Co.

J. Water-Reducing Admixture: ASTM C494, Type A.

1. Standards:
 - a. MasterPozzoloth 200, 210, 322 by Master Builders Solutions.
 - b. WRDA with Hycol by GCP Applied Technologies.
 - c. Eucon WR-75 by The Euclid Chemical Co.

K. Mid-Range Water Reducing Admixture: ASTM C494, Type A.

1. Standards
 - a. Daracem 55 by GCP Applied Technologies.
 - b. Mira Series by GCP Applied Technologies
 - c. MasterPolyheed Series 900, 1025, or 997 by Master Builders Solutions.
 - d. Eucon Series by Euclid Chemical Co.

- e. Plastol Series by Euclid Chemical Co.
- L. High Range Water-Reducing Admixture: ASTM C494, Type F.
 - 1. Standards:
 - a. MasterGlenium 3030 by Master Builders Solutions.
 - b. MasterRheobuild 1000 by Master Builders Solutions.
 - c. Daracem Series by GCP Applied Technologies.
 - d. Adva Series by GCP Applied Technologies.
 - e. Eucon 37 by The Euclid Chemical Co.
 - f. Eucon 537 by The Euclid Chemical Co.
 - g. Plastol Series by The Euclid Chemical Co.
 - 2. High range water reducing admixture shall be added to the concrete at the batch plant. Field added HRWR is allowed to correct slump non-compliance.
- M. Accelerating Admixture: ASTM C494, Type C.
 - 1. Standards:
 - a. MasterSet FP20 or MasterSet AC534 Accelerator by Master Builders Solutions.
 - b. Polarsset by GCP Applied Technologies.
 - c. Accelguard 80 or 90 by The Euclid Chemical Co.
 - 2. The accelerator shall be non-chloride, non-corrosive. Calcium chloride, or admixtures containing more than 0.05% chloride ions, are not permitted.
 - 3. Thiocyanate-based accelerators, when used at the given dosage rate, shall contribute thiocyanate ions less than 0.30 percent by weight of cement. This shall be certified by the manufacturer.
- N. Water-Reducing & Retarding Admixture: ASTM C494, Type D.
 - 1. Standards:
 - a. MasterSet R122 or MasterSet R300 by Master Builders Solutions.
 - b. Daratard-17 by GCP Applied Technologies.
 - c. Eucon Retarder-75 by The Euclid Chemical Co.
- O. Integral Curing Admixture:
 - 1. Standards:
 - a. E5 Internal Cure – Specification Products

P. Synthetic Fibers (for slabs on grade, not polished):

1. Virgin (non-recycled), nylon or polypropylene fibers.
2. 3/4 inch length (unless specified otherwise).
3. When using nylon fibers, add fibers at a minimum dosage rate of 1.0 pound/cubic yard. When using fibrillated polypropylene fibers, add fibers at a minimum dosage rate of 1.5 pounds/cubic yard. Use in strict accordance with manufacturer's instructions.
4. Fibers shall be introduced into the concrete at the batch plant, and it shall be noted on all delivery tickets.
5. Standards:
 - a. Fiberforce 300 by ABC Polymer.
 - b. Fibermesh 300 by SIKA.
 - c. Forta Ultra-Net by Forta Corp.

2.4 RELATED MATERIALS

A. Curing Compound: ASTM C309.

1. Clear curing, non-yellowing under ultra violet light.
2. Sodium silicate products are not permitted.
3. Compatible with applied sealers and finishes specified for the concrete surfaces to be cured.
4. Curing compound shall be applied at the coverage rate to comply with ASTM C309.
5. Contractor is responsible for verifying curing compound is compatible with floor finish or waterproofing system. Return of "Reviewed" curing compound submittal by Structural EOR does not imply compatibility with finishes.
6. Not permitted for polished concrete. Use moisture retention covers.

B. Moisture Retention Cover: ASTM C171.

1. Waterproof paper or polyethylene film.

C. Evaporation Retardant:

1. Apply in accordance with manufacturer's instructions.
2. Standard:
 - a. MasterKure ER50 by Master Builders Solutions.
 - b. EUCO-BAR by the Euclid Chemical Co.

D. Epoxy Bonding Adhesive:

1. Two-part structural epoxy adhesive.

2. Use to bond fresh, plastic concrete or patching mortar to hardened concrete.
3. Standards:
 - a. Sikadur 32, Hi-Mod by Sika Corporation.
 - b. Euco 452 by The Euclid Chemical Co.

E. Adhesive Anchor System:

1. Moisture insensitive epoxy.
2. Use to anchor reinforcing steel into hardened concrete.
3. Standards:
 - a. Hilti HIT HY 200 V3 by Hilti Fastening Systems.
 - b. Vertical holes: Sikadur 32, Hi-Mod by Sika Corporation or Euco 452MV Epoxy by The Euclid Chemical Co.
 - c. Horizontal holes: Sikadur Injection Gel by Sika Corporation.
 - d. Overhead application: Sikadur 31, Hi-Mod Gel by Sika Corporation Euco 452 Gel by The Euclid Chemical Co.
 - e. Approved equal: Submit literature including depth of embedment to fully develop reinforcing bars and spacing requirements.
4. Drilled hole size and installation procedure shall conform to manufacturer's instructions.
5. Use carbide bit drill to prevent damage to reinforcement

F. Patching Material:

1. Use to repair honeycombed and other defective concrete that will be concealed.
2. Standards:
 - a. SikaTop 122 PLUS (horizontal surfaces), by the Sika Corporation.
 - b. SikaTop 123 PLUS (overhead and vertical surfaces), by the Sika Corporation.
 - c. MasterEmaco T310 CI (horizontal surfaces) by Master Builders Solutions.
 - d. MasterEmaco N420 CI (vertical and overhead surfaces) by Master Builders Solutions.

G. Isolation Joint Filler: ASTM D1752

1. Isolation joint filler shall be flexible, lightweight, non-straining, polyethylene, and closed cell. It shall be a chemical-resistant, ultraviolet stable, non-absorbent, low density, compressible foam.
2. The joint filler shall have a pre-scored "removable strip" to provide a uniform sealing reservoir in the joint. This reservoir shall be used to provide a sealed joint with a flexible sealant in accordance to the Construction Documents.
3. Use at isolation joints filler when called out at columns and adjacent to walls.
4. Standards:

- a. Deck-O-Foam Expansion Joint Filler by W.R. Meadows.
 - b. Foamtech by NMW, Inc.
- H. Bondbreaker for Isolation Joints: Liquid, paper or plastic sheet to break bond between freshly placed concrete and hardened concrete.
- I. Waterstops:
- 1. PVC flat ribbed or dumbbell type.
 - a. Provide waterstops with center bulb at all expansion joints and as detailed.
 - b. Split-fin type waterstop is acceptable at construction joints and expansion joints.
 - c. Provide all corner joints and tee joints in prefabricated assemblies. Field splices shall be used for butt joints only, using controlled indirect heating element per manufacturer's requirements.
 - d. Standards:
 - 1) Greenstreak Plastic Products Company.
 - 2) Vinylex Corporation.
 - 3) Wirestop, Paul Murphy Plastics Company.
 - 4) Durajoint, Tamms/Horn
 - 2. Waterstop-RX by American Colloid Company
 - a. Keep dry at all times.
 - b. RX101: Use with concrete with two rows of reinforcement and with 3" minimum concrete cover.
 - c. RX102: Use with one row of reinforcement and with 2" minimum concrete cover.
 - d. Install in strict accordance with manufacturer's requirements.
- J. Self-leveling Underlayment Concrete:
- 1. Material shall be compatible with floor finishes.
 - 2. Material shall be used on floors that will receive a floor covering.
 - 3. Standards:
 - a. Ardex K-15 by Ardex Engineered Cements.
 - b. Level-Right by Gyp-Crete Corp.
 - c. Flo-Top/Flo-Top 90 by The Euclid Chemical Co.
- K. Self-leveling, Polymer Modified Industrial Topping
- 1. Material shall be compatible with floor sealer.
 - 2. Material shall be used on exposed concrete floors.

3. Standards:
 - a. MasterTop Topping 112, by Master Builders Solutions.
 - b. Thin Top/Thin Top Supreme by The Euclid Chemical Co.

- L. Industrial Floor Joint Filler *(Option #1)*
 1. Flexible epoxy joint filler with 100 percent solids.
 2. Minimum Shore D hardness of 50.
 3. Use to fill control joints and construction joints in slabs on grade. Apply filler a minimum of 3 months after concrete placement.
 - a. The Contractor that installs the joint filler shall return to the project six months after occupancy and shall fill in the separations or cracks that have occurred at the control joints and the construction joints with the same material or with an approved companion material by the same manufacturer.
 4. Standards:
 - a. Euco 700 by The Euclid Chemical Co.
 - b. MM-80 by Metzger/McGuire.

- M. Industrial Floor Joint Filler * (Option #2)*
 1. Flexible multi-part urethane sealant.
 2. Non-sag or self-leveling.
 3. Use to fill control joints and construction joints in slabs on grade.
 4. Standards:
 - a. Eucolastic II by The Euclid Chemical Co.
 - b. THC-900 or THC-901 by Tremco Inc.

- N. Reinforced Polyethylene Underslab Vapor Retarder: Co-extruded Polyolefin Membrane meeting ASTM E 1745, Class A, single or multi-layer, not less than 15 mils thick. Sheet manufactured in multilayer extrusion process using virgin (non-recycled) polyolefin resins.
 1. Maximum perm rating of 0.02 perms (U.S.) per ASTM E-96 / F-1249, Procedure B.
 2. Puncture resistance of 2200g or greater per ASTM D-1709,B.
 3. Include manufacturer's recommended adhesive or pressure-sensitive joint tape and include manufacturer's proprietary penetration flashing for all thru slab penetrations.
 4. Products: Subject to compliance with above requirements, provide one of the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.

- b. [Insulation Solutions, Inc.](#); Viper Vaporcheck II, 15 mils.
- c. [Raven Industries, Inc.](#); Vapor Block 15.
- d. [Reef Industries, Inc.](#); Griffolyn 15 mil.
- e. W. R. Meadows, Inc.; Perminator 15.

O. Penetrating Liquid Floor Treatment

- 1. Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces .
- 2. Standards:
 - a. Euco Diamond Hard – Euclid Chemical
 - b. MasterKure HD 300WB – Master Builders Solutions
 - c. Liqui-Hard Ultra – W.R. Meadows, Inc.

2.5 PROPORTIONING CONCRETE MIXES

- A. Establish concrete proportions to produce homogeneous, durable mixes with the required average strength based on the appropriate amount of overdesign as required by Section 5.3 of ACI 318.
- B. Proportion concrete mixes to provide workability and consistency to permit concrete to be worked readily into the corners and angles of the forms and around reinforcement by the methods of placement and consolidation to be employed, without segregation or excessive bleeding.
- C. Include a water-reducing admixture, a mid-range water reducing admixture, or high range water-reducing admixture, used in strict accordance with manufacturer's instructions, in all mix designs. Specified minimum cement contents are based on the use of such admixtures.
- D. Include an air-entraining admixture in mix designs for all concrete exposed to freezing and thawing during service.
- E. Base mix design on saturated surface dry aggregates. Adjust the amount of mixing water added at the batch plant for the moisture condition of the aggregates.
 - 1. The water-cementitious ratio given for each class of concrete shall be calculated using the amount of Portland Cement plus flyash plus Slag Cement. For Class C flyash, use 100 percent of flyash, and for Class F flyash, use 80 percent of flyash. For Slag Cement, use 100 percent of the Slag Cement.
- F. Flyash may be used as a cement substitute with a maximum 20 percent substitution rate on a pound for pound basis for Class C flyash and a maximum 15 percent substitution rate using 1.25 pounds of flyash for 1.00 pound of cement for Class F flyash.
 - 1. Flyash not permitted in concrete to be polished.

G. Slag Cement may be used as a substitute for Portland Cement on a pound for pound basis. The maximum substitution rate shall be 50%, except for Class 4ESOG (exterior concrete) the max substitution rate shall be 30%.

H. When Slag Cement and flyash are used in the same concrete mix, the maximum substitution rates for Slag Cement and flyash shall comply with the following:

Portland Cement/Slag Cement/Flyash Ratio

Exterior concrete (Classes 4ESOG)..... 70%/20%/10%

All other concrete 50%/30%/20%

I. For concrete to be cast during cold weather, the maximum substitution rate for Slag Cement shall be 30%. If slag Cement and flyash are used in the same concrete mix, the maximum substitution rates shall comply with a ratio of Portland Cement/Slag Cement/Flyash of 70%/20%/10%.

J. Water Soluble Chloride Ion Content:

1. Maximum percent in concrete by weight of cement:
 - a. Reinforced concrete exposed to earth or weather: 0.15.
 - b. Other reinforced concrete construction: 0.30.

K. Slump:

1. Mixes containing high range water-reducing admixture: 5 to 8 inches.
2. Mixes containing mid-range water-reducing admixture: 5-6 ½ inches.
3. Mixes containing water-reducing admixture: 5 inches maximum.

L. Adjustments to the approved mix designs may be requested by the Contractor when job conditions, weather, test results, drying times or other circumstances warrant. These revised concrete mix designs shall be submitted to the Architect/Engineer for approval prior to their use.

M. Concrete Mix Classes:

1. Class 3 concrete: Footings
 - a. Compressive strength at 28 days: 3000 psi.
 - b. Minimum cement content: 423 lb/cu yd.
 - c. Maximum water-cementitious ratio: 0.58
 - d. Air content: Optional.
 - e. Water-reducing admixture required.

2. Class 4 concrete: Foundation walls and piers
 - a. Compressive strength at 28 days: 4000 psi.
 - b. Minimum cement content: 517 lb/cu yd.
 - c. Maximum water-cementitious ratio: 0.48.
 - d. Air content: 0 to 3 percent.
 - e. High range water-reducing admixture required.
3. Class 4SOG concrete: Interior Slabs on grade
 - a. Compressive strength at 28 days: 4000 psi.
 - b. Minimum cement content: 517 lb/cu yd.
 - c. Maximum water-cementitious ratio: 0.48.
 - d. Air content: 0 to 3 percent.
 - e. Mid range water-reducing admixture required.
 - f. Synthetic fibers required.
4. Class 4SOG-P concrete: Interior Slabs on grade to be polished
 - a. Compressive strength at 28 days: 4000 psi.
 - b. Minimum cement content: 517 lb/cu yd.
 - c. Maximum water-cementitious ratio: 0.48.
 - d. Air content: 0 to 3 percent.
 - e. Mid range water-reducing admixture required.
 - f. Flyash not permitted.
 - g. Aggregate shall be single-source River Rock as approved by the Architect, max. size $\frac{3}{4}$ " nominal.
 - h. No synthetic fibers – reinforce with 6x6-W2.9xW2.9 WWF.
5. Class 4EXT concrete: Exterior exposed concrete including slabs on grade shown on "S" series drawings and concrete with Architectural Finish, per drawings.
 - a. Compressive strength at 28 days: 4500 psi.
 - b. Minimum cement content: 564 lb/cu yd.
 - c. Maximum water-cementitious ratio: 0.40.
 - d. Coarse aggregate: Crushed stone.
 - e. Air content: 6+ 1 percent.
 - f. High range water-reducing admixture required.
 - g. Synthetic fibers required.

2.6 BATCHING AND MIXING

- A. Batch and mix concrete in accordance with ASTM C94.
- B. Mix concrete until there is a uniform distribution of materials.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Before forms are constructed, reinforcement is installed, or concrete is placed, inspect the installed work of this and other Sections and verify that all such work is complete.
- B. Verify that forms are constructed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.
- C. Verify that concrete can be placed to the required lines and elevations with required cover for reinforcement.
- D. Prevent groupings of conduits, pipes and sleeves in concrete that would significantly impair the strength of the concrete.
- E. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Architect/Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved and reviewed by the Engineer.

3.2 CONSTRUCTION OF FORMS

- A. Provide substantial form construction, sufficiently tight to prevent leakage of concrete, and able to prevent excessive deflection when filled with wet concrete.
- B. Layout:
 - 1. Form all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings. Provide 3/4" chamfers on all exposed corners of concrete except those abutting or aligning with masonry.
 - 2. Layout formwork to eliminate need for cutting of concrete after it is in place.
 - 3. Make proper provisions for all openings, offsets, recesses, anchorage, blocking, and other features of the Work as shown, or required.
 - 4. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installation.
 - 5. Carefully examine the Drawings and Specifications and consult with other trades as required relative to provisions for openings, reglets, chases and other items in the forms.
- C. Bracing:
 - 1. Properly brace and tie the formwork together to maintain position and shape and to ensure safety of workers.
- D. Construct all formwork straight, true, plumb, level and square within tolerances as specified in ACI 117.

- E. Keep formwork sufficiently wetted to prevent joints opening up before concrete is placed.
- F. Provide holes at bottom of formwork for cleaning and inspection. Close prior to placing concrete.
- G. Forms for concrete surfaces exposed to public view:
 - 1. Lap form facing materials over the concrete or previous placement at construction joints exposed to view. Ensure formwork is placed against hardened concrete so offsets at construction joints attain specified tolerances and minimize loss of mortar.
 - 2. Where seams are acceptable for architecturally exposed formed concrete surfaces, orient as indicated by the Drawings. If not indicated in the Drawings, orient in the least visible position.
 - 3. If necessary, back fasten forms to the supporting members for category to prevent visible blisters on the finished concrete surface at the fastener locations.
 - 4. Where as-cast finishes are required, install forms so that no dressing will be required in the finishing operation.
 - 5. Wall ties: Where embedded ties must be used, lay out in regular pattern approved by Architect. (If ties can be eliminated from concrete for short pours, this is preferable.)
- H. Form footings and pile caps with wood, unless it can be demonstrated to the satisfaction of the independent geotechnical testing and inspection agency that the footing excavation is sufficiently stable to prevent sloughing of the sides of the excavation into the bottom of the excavation.

3.3 FABRICATION AND INSTALLTION OF REINFORCEMENT

- A. Fabrication, including bar bending shall comply with the requirements of ACI 318, ACI 315 and CRSI "Manual of Standard Practice".
- B. Before placing reinforcement and again before placing concrete clean reinforcing of loose rust and mill scale, dirt, ice and other materials that reduce concrete bond.
- C. Installation shall be completed in accordance with reviewed and corrected shop drawings. A set of shop drawings marked accordingly for "Field Use" shall be used during the installation.
- D. All reinforcement and welded wire reinforcement shall be held securely in design position by wiring to supports in accordance with the contract documents, and, in addition, any other supports needed to secure every bar against displacement shall be provided. Provide supports at frequencies in accordance with CRSI manual of Standard Practice, but in no case less than frequencies specified by Contract Drawings. Overhanging tails shall be supported positively. All bars bent and/or displaced during concrete placement shall be straightened and repositioned before they are encased in concrete.

- E. Concrete protection shall comply with the requirements of ACI 318 except as modified on the Structural Drawings.

F. Obstructions:

1. In the event conduits, piping, inserts, sleeves or any other items interfere with placing reinforcement as indicated on the Drawings or as otherwise required, immediately consult the Architect/Engineer and obtain approval of new procedure before placing concrete.
2. Do not field bend or cut reinforcing unless specifically approved by Architect/Engineer.

3.4 PREPARATION FOR CONCRETE PLACEMENT

- A. Install items to be embedded in concrete. Set steel frames, angles, trench drains, bolts, inserts, and other such items required to be anchored in the concrete before the concrete is placed. Position accurately and secure against displacement.
1. Anchor rods shall be installed in accordance with the tolerances indicated in the AISC-303 Code of Standard Practice for Steel Buildings and Bridges, Article 7.5.
 2. Do not embed aluminum items in concrete.
- B. Remove wood scraps, ice, snow, frost, standing water and debris from areas in which concrete will be placed.
- C. Notify the Architect/Engineer when concrete placement is planned. Allow sufficient time for review of formwork, reinforcement and embedded items, and for any required corrective work.
- D. Before fresh concrete is placed against hardened concrete, retighten forms and suitably clean and moisten the surface of the hardened concrete for bond to the fresh concrete.
- E. Thoroughly moisten subgrade on which concrete is to be placed. Do not place concrete on frozen subgrade.
- F. Thoroughly clean conveying and handling equipment.
- G. Installation of vapor barrier beneath slab on grade shall be in accordance with ASTM E1643.
1. Follow manufacturer's instructions for placement (including laps, sealing around penetrations and foundation walls), protection and repair.
 2. Place vapor barrier sheeting with the longest dimension parallel to the direction of the concrete pour.
 3. Do not use reinforcing supports that will puncture the vapor barrier.
 4. Repair all damaged areas.

3.5 PLACING CONCRETE

- A. Addition of water to the concrete during transport or at the site is strictly prohibited. Slump may be adjusted at the site by the addition of high or mid-range water reducer.
- B. Convey concrete by methods and equipment capable of supplying concrete from mixer to place of final deposit without segregation and such that detectable setting of concrete does not occur before adjacent concrete is placed.
- C. Use pumping equipment with sufficient design and pumping capacity to ensure a practically continuous flow of concrete at the point of discharge without segregation.
 - 1. Do not add water or alter the mix design in any way to facilitate pumping.
 - 2. Pumping concrete through aluminum pipe is prohibited.
- D. Concrete may be placed in walls by "free fall" providing a tremie is used to control concrete to fall without hitting the formwork, reinforcing, or any embedded items.
- E. Do not bear concrete conveying equipment on fresh concrete or reinforcement.
- F. After concrete placing has started, provide continuous operation until placement of the section is complete. Do not place a greater section at one time than can be properly finished.
- G. Deposit concrete as nearly as practicable to its final position to avoid segregation due to rehandling or flowing.
- H. Place concrete at a rate such that the concrete is at all times plastic and flows readily between reinforcement and into corners of forms without segregation.
- I. Place concrete in all slabs, mats, and footings for the full depth of the member at one time in such a way as to prevent a horizontal cold joint from occurring.
- J. All concrete shall be discharged into the structure within 90 minutes after batching.
- K. Do not place concrete that has partially hardened, been retempered or contaminated by foreign materials.

3.6 CONSOLIDATION

- A. Thoroughly consolidate concrete with high frequency vibrators, working the concrete thoroughly around reinforcement and embedded items and into corners of forms.
- B. Use a sufficient number of vibrators, of appropriate size and type, to provide complete vibration throughout the concrete at the same rate it is placed.

1. Provide at least one spare vibrator at the site for use in case of breakdown.
- C. Provide properly spaced vibration of duration sufficient to produce complete consolidation, but not long enough to cause segregation. Continue vibration until mortar just begins to puddle at the surface. Remove any excess free water that collects on the surface.
- D. Do not use vibrators to transport concrete within forms.
- E. Supplement internal vibration with manual consolidation methods and external form vibration as required to produce concrete free of voids, honeycomb and rough surfaces.
 1. Vibrate forms in such a way as to avoid form displacement.
- F. For slabs to receive Polished Concrete Finishing, do not consolidate concrete with the use of vibration or tamping. See Section 033543 – Polished Concrete Finishing.

3.7 FINISHING SLABS

A. Tolerances:

1. Finish level slabs to conform to the following minimum F-numbers.

- a. For each slab on grade pour (not polished):

SOFF (specified overall flatness) = 25

MLFF (minimum local flatness) = 17

SOFL (specified overall levelness) = 20

MLFL (minimum local levelness) = 15

- b. For each slab on grade pour (polished concrete):

SOFF (specified overall flatness) = 45

MLFF (minimum local flatness) = 30

SOFL (specified overall levelness) = 25

MLFL (minimum local levelness) = 17

2. Compliance tests shall comply with Field Quality Assurance article.
3. Remedial work in areas of non-compliance may be required at the Owner's request. This work shall be accomplished by grinding and/or using a self-leveling underlayment concrete or by using a self-leveling, polymer modified industrial topping per PART 2 - PRODUCTS - RELATED MATERIALS article.

B. Screeding:

1. Immediately after placing, strike off excess concrete with a straightedge to bring the top surface to proper grade, aligning it to the contours of screeds.
2. Screed off edge forms, intermediate screed strips or pipe set accurately and firmly to the required elevations and contours for the finished surface.
3. Move straightedge across the concrete surface with a sawing motion, advancing forward a short distance with each movement. There should be a surplus of concrete against the front face of the straightedge to fill in low areas as the straightedge passes over the surface.
4. Complete screeding before any excess moisture or bleeding water is present on the surface.

C. Bull Floating or Leveling:

1. Immediately after screeding, bull float the concrete surface, eliminating high and low spots, smoothing the surface and embedding the coarse aggregate.
2. Avoid overworking the concrete. Do not close up or seal the surface of the concrete.
3. Complete bull floating before any excess moisture or bleeding water is present on the surface.

D. Floating:

1. Begin floating operations when bleeding water has disappeared or been removed from the surface and when the surface has stiffened sufficiently to support the operation.
 - a. Do not use dry cement and sand to take up bleeding water.
2. Hand or power float the concrete surface, removing slight imperfections and producing a relatively even and true surface with a uniform, sandy texture prepared for final finishing.
3. Avoid overworking the concrete. Do not close up or seal the surface of the concrete.
4. Surfaces to received Polished Concrete Finishing shall be hand floated only – no power. Apply float finish.

E. Final Finishing:

1. Hard Trowel Finish: All slabs unless otherwise specified.
 - a. Immediately after floating, use power trowel for first trowelling to produce a smooth surface relatively free of defects.
 - b. For first trowelling, use hand trowelling in areas inaccessible to power trowelling.

- c. Use hand trowel and heavy pressure for final trowelling after concrete has become hard enough to produce a ringing sound as the trowel is moved over the surface. Produce a smooth, hard, dense surface, uniform in texture and appearance and free of defects.

2. Broom Finish: Slip-resistant surfaces.

- a. Immediately after floating, draw a broom across the concrete surface transversely to the main direction of traffic, producing a coarse, scored, slip-resistant texture.

3.8 FORM REMOVAL

- A. Remove formwork in an approved manner under competent supervision to avoid damage to the concrete. Use sufficient care to prevent spalling.
- B. The Contractor shall bear full responsibility for form removal. Concrete damaged by too early removal of supports shall be repaired to the satisfaction of the Architect/Engineer, or replaced.
- C. Do not remove shores and other supports until concrete has attained sufficient strength to support, without objectionable deflections, its own weight plus all anticipated construction loads.
- D. Do not remove formwork for vertical elements (foundation walls and piers) until the day after casting of the concrete. Do not damage concrete surface during form removal.

3.9 FORM MAINTENANCE

- A. Clean and recondition formwork before each use. Repair damage to formwork during placing, removal, or storage. Do not use formwork with repairs or patches which would result in adverse effects to the concrete finish.
- B. Store formwork and form materials in a manner to prevent damage or distortion.

3.10 FINISHING FORMED SURFACES

- A. Rough Form Finish: All formed concrete surfaces not exposed to public view.
 1. After being cleaned and thoroughly dampened, fill tie holes solid with patching mortar matching the color of the surrounding concrete.
 2. Patch defective areas in accordance with REPAIR OF DEFECTIVE SURFACES article below.
 3. Chip or rub off fins and projections as follows:
 - a. Exceeding 1" (Class D per ACI 347) in height unless otherwise noted.

- B. Exposed to Public View Formed Concrete Surface: Architectural Finish (per drawings).
 - 1. Tie holes in a regular pattern that has been approved by the Architect need not be filed.
 - 2. Patch defective areas in accordance with REPAIR OF DEFECTIVE SURFACES article below.
 - 3. Completely remove all fins and projections.
 - 4. Final concrete finish shall be uniform and free from defects. Any areas with defects that cannot be repaired per article 3.11 to the satisfaction of the Architect shall be removed and replaced at no expense to the Owner.

3.11 REPAIR OF DEFECTIVE AREAS

- A. Remove honeycombed and other defective concrete, exposing sound concrete. Cut and chip edges straight and perpendicular to the surface or slightly undercut to a depth of ½". Feathered edges are not permitted.
- B. Dampen areas to be patched and surrounding areas. Patch with patching material according to manufacturer's recommendations. Submit data on patching material to engineer for review prior to starting repair.
- C. After surface water has evaporated from the area to be patched, apply patching material to the surface.
- D. Apply curing to the repaired surface as soon as possible and maintain for a minimum of 3 days.

3.12 CURING

- A. Maintain concrete in a moist condition for at least 5 days at temperatures above 70°F and at least 7 days at temperatures between 40°F and 70°F.
- B. Curing Slabs: Curing compounds, moisture retention covers, or internal curing admixture. (Curing compounds not permitted for polished slabs. Use moisture retention cover.)
 - 1. Apply curing compounds to the concrete surface, immediately after final finishing of the concrete, in accordance with manufacturer's instructions to comply with ASTM C309.
 - a. If it is determined that the curing compound is not compatible with the floor finish after the curing compound has been applied, then the curing compound must be removed by mechanical abrasion.
 - 2. Place moisture retention covers on the concrete surface immediately after final finishing of the concrete. Lap edges 6 inches and seal, creating a moisture barrier that must remain intact for the duration of the curing period.

3. Provide internal curing admixture.

C. Curing Formed Surfaces:

1. Formed surfaces may be cured by leaving forms in place. During hot, dry weather, keep forms moist by sprinkling.
2. When forms are removed before the end of the curing period, apply curing compound to walls and piers.

3.13 POLISHED CONCRETE FINISHING

- A. Where called for on drawings, concrete slabs shall be ground and polished as specified in Section 033543.

3.14 JOINTS

A. Construction Joints:

1. Locate construction joints so as not to impair the strength of the structure.
2. With the exception of slabs on grade, continue reinforcement across construction joints.
3. Thoroughly clean the concrete surface at construction joints and remove laitance before placing adjoining concrete.
4. In slabs on grade with control joints, locate construction joints at control joint locations.

B. Slab on Grade Control Joints:

1. Sawcut Control Joints:

- a. Conventional: Sawcut joints as soon as the blade does not dislodge aggregate and when the edges of the cut do not ravel. For slabs to remain exposed, use a blade that has a triangular arbor configuration to reduce edge releveling or dislodging aggregates. Complete saw-cutting before shrinkage stresses become sufficient to produce cracking. Sawcut joints in straight lines to avoid unsightly joints.
- b. SOFF-CUT System: Saw cut control joints with SOFF-CUT System Model G-2000 or GS-1000, 1/8" wide x 1 3/16" deep joints, within (2) hours after final finish at joint location. Do not disturb final slab finish. Saw cuts shall be made with SOFF-CUT saw as manufactured by SOFF-CUT International, Corona, Calif. Equipment shall be used in accordance with manufacturer's instructions. SOFF-CUT System shall not be used for slabs greater than 6" thick.

2. Hand-Tooled Control Joints: Tool joints with hand groovers in straight lines to avoid unsightly joints.

3.15 APPLICATION OF PENETRATING LIQUID FLOOR TREATMENT

- A. Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 - 4. Rinse with water; remove excess material until surface is dry.
 - 5. Apply second coat in similar manner if surface is rough or porous.

3.16 HOT WEATHER CONCRETING

- A. Follow the provisions of this Article and ACI 305.1 when the rate of evaporation of surface moisture from the concrete exceeds 0.18 lb/sq ft/hr (Figure 2.1.5, ACI 305.1).
- B. Control concrete setting time with the use of water-reducing & retarding admixtures as required to facilitate placing and finishing operations.
- C. Before placing concrete, spray the subgrade, forms and reinforcement with water to keep them cool and to prevent absorption of water from the concrete.
- D. Transport, place and finish concrete as quickly as practicable. Plan concrete delivery, placing techniques and consolidation methods to avoid cold joints.
- E. Maximum temperature of concrete during placing: 90°F
 - 1. Exception: At slabs to be polished, max. temperature of concrete during placing: 85°F.
- F. Apply evaporation retardant to the surface of the fresh concrete after screeding and as needed during finishing.
- G. Take additional precautions as necessary to prevent plastic shrinkage cracking.
- H. Start curing the concrete immediately after finishing operations have been completed.

3.17 COLD WEATHER CONCRETING

- A. Follow the provisions of this Article and ACI 306.1 when the average daily temperature (average of the highest and lowest temperature during the period from midnight to midnight) is less than 40°F.

- B. Control concrete setting time with the use of accelerating admixtures and water-reducing accelerating admixtures as required to facilitate placing and finishing operations.
 - 1. Do not use calcium chloride as an accelerating admixture. Only the specified accelerators shall be used.
- C. Temperature of concrete during placing: 55°F to 75°F.
- D. Maintain the temperature at the concrete surface between 55°F and 75°F until the concrete reaches 70 percent of its specified compressive strength by providing heated enclosures and insulated blankets.
 - 1. Construct weathertight enclosures, allowing the heated air to circulate around the outer edges of the concrete.
 - 2. Provide a sufficient number of heaters to assure an even temperature within the enclosure.
 - a. Use indirect-fired heaters vented to the exterior where heat is supplied to the top of fresh concrete to prevent dusting due to carbonation.
 - 3. Add moisture to the heated air as required to maintain a minimum relative humidity of 40 percent within the enclosure. Do not allow any concrete surface to become dry during the protection period.
 - 4. Maintain enclosures for 24 hours after heating has been discontinued to allow the concrete to cool gradually.
 - 5. Lap insulating materials and cover the edges and corners of the concrete to provide complete and adequate protection.
 - 6. Wrap piers and walls with insulated blankets.
 - 7. Monitor the temperature of the concrete surface regularly with suitable thermometers throughout the protection period.
- E. Provide insulation or temporary backfill to protect all earth supported concrete from damage due to frost heaving.

3.18 PROTECTION

- A. Protect finished concrete surfaces from damage by construction equipment, materials or methods and by rain or running water.
- B. Do not load any concrete member in such a way as to overstress the concrete.
- C. Protect concrete surfaces to receive Polished Concrete Finishing with floor slab protective covering.

3.19 FIELD QUALITY CONTROL

- A. Owner's Testing and Inspection Agency: Conduct testing and write reports as outlined in this Article under provisions of Division 1.
- B. Reinforcement inspection:
1. Contractor shall notify the Architect/Engineer and the Owner's Testing and Inspection Agency, if applicable, when reinforcement for a pour is nearing completion so that reinforcing steel in place may be reviewed.
 - a. For all slabs and mats; the installation of all reinforcement shall be completed by noon of the day prior to casting the concrete.
 - b. Allow sufficient time for setters to make adjustments or corrections so that reinforcing steel correct in size, shape and position will be in place when concreting is started.
 2. The Owner's Testing and Inspection Agency shall inspect all in-place reinforcing steel for compliance with the contract documents and approved shop drawings. This inspection shall include, but not necessarily be limited to: bar size, concrete cover, lap lengths mechanical butt splices, and bar supports. Daily inspection reports shall address all areas which have been inspected, and any deficiencies.
- C. Strength Tests:
1. During the progress of the work, take samples of concrete for strength tests in accordance with ASTM C172.
 2. Make and cure a minimum of 4 cylinders in accordance with ASTM C31 for each of the following:
 - a. Each 100 cubic yards of concrete.
 - b. Each 5000 square feet of surface area for slabs and walls.
 - c. Each class of concrete placed in a day's work.
 3. Cylinders may be either 6 x 12 inches or 4 x 8 inches.
 4. Test each group of 4 cylinders in accordance with ASTM C39 as follows:
 - a. Two field cured cylinders to be tested at 7 days or just before anticipated time of form removal.
 - b. Two laboratory cured cylinders to be tested at 28 days.
 5. A strength test is the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
 6. The strength level of an individual class of concrete will be considered satisfactory if each strength test equals or exceeds the specified compressive strength.
 7. If the strength level of an individual class of concrete is found to be unsatisfactory, conduct core testing in accordance with ASTM C42, impactometer testing or load testing on the area of concrete in question as

required by the Architect/Engineer. If such additional testing does not produce acceptable results, corrective measures will be required to ensure structural adequacy.

a. Make appropriate adjustments to the concrete mix designs as required.

D. Slump Tests:

1. Make one slump test in accordance with ASTM C143 with each group of 4 cylinders.
2. When concrete is pumped, make the slump test at the point of placement.
3. Keep a slump cone available at the site for additional testing as required.

E. Air Content Tests: Make one air content test in accordance with ASTM C173 or ASTM C231 with each group of 4 cylinders for air-entrained concrete mixes at point of discharge.

F. Rejection of Concrete:

1. Any concrete that does not meet the specified requirements for air-entrainment, concrete temperature, or slump shall not be placed until corrective measures have been taken, and the concrete has been re-tested to indicate compliance.
2. The Owner or Owner's Construction Representative shall authorize one party to be responsible for rejection of concrete.

G. Field Quality Control Test Reports:

1. Include the following information in test reports:
 - a. Project identification and portion of structure represented.
 - b. Concrete mix class and specified compressive strength requirements.
 - c. Weather conditions and air temperature.
 - d. Concrete temperature, slump and air content test results.
 - e. Dates of placing and testing.
 - f. Method of curing (field or laboratory).
 - g. Strength test results.
 - h. Technician's name, certification number with expiration date.

H. Compliance tests for F-numbers shall be performed for all level slabs.

1. Slab measurements and computation of F-numbers shall conform to ASTM E1155.
2. The maximum area to be considered for minimum local FF and FL numbers shall be 400 square feet.
3. Compliance tests shall be performed using the Dipstick Floor Profiler or the Face Floor Profileograph.

4. Compliance tests shall be performed by the Owner's Testing and Inspection Agency.
5. Compliance tests shall be completed within 72 hours after the final finishing is complete and prior to the removal of any forms and shoring.
6. If cold weather protection prevents testing, then compliance tests shall be performed immediately after the removal of the protection and prior to the removal of any forms and shoring.
7. Submit slab finish compliance test reports within one week of testing.

- END -

CLEAR CREEK WELCOME CENTER
DAPW PROJECT NO: 84003001-22-058-C1
FRP NO. 21071.00

CAST-IN-PLACE CONCRETE

SECTION 033000

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SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Polished concrete finishing by grinding and polishing.
2. Application of concrete densifier.
3. Application of surface coating.
4. Concrete for polished concrete, including concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.02 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Schedule meeting after receipt of approved design mixtures. Review concrete design mixture placement requirements and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished 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. Cast-in-place concrete subcontractor.
 - e. Polished concrete finishing Subcontractor.
2. Review the following.
 - a. Potential use of cold- and hot-weather concreting procedures.
 - b. Curing procedures.
 - c. Location of construction joints.
 - d. Protection of adjacent, non-polished slab areas.
 - e. Requirements for proper execution of surface grinding.
 - f. Application of cleaner, concrete hardener, sealer.

- g. Concrete repair procedures and materials.
- h. Protection of polished concrete.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- C. Stepped Grinding and Polishing Sequence: Submit proposed sequence of grinding diamond head grits to be used in each step, and product literature for diamond heads to be used.
- D. Concrete protection plan and procedures: Develop and submit concrete protection plan and procedures. Address the following:
 - 1. Materials and their method of installation for protection of finished concrete.
 - 2. Procedure for addressing spill.
 - 3. Cleaning chemical approved for use on polished concrete.
 - 4. Absorptive materials approved for use on polished concrete.
 - 5. Plan to communicate plan to subcontractors and vendors.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For concrete polisher mechanic.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.06 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of polished concrete mix, cast and polish field sample panels to demonstrate the placement of the concrete substrate, polishing technique, product application, and range of exposed aggregate exposed by final finish. Produce full-scale panels, approximately 72 by 72 inches (1830 by 1830 mm) minimum. Provide up to three panels, to confirm technique and the expected range of finish, color, and appearance variations.
 - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed work.
 - 3. Demolish and remove field sample panels when directed.

1.07 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1. Close access to areas of work during application of surface treatments.
 2. Protect completed polished slab areas from damage.
- B. Maintain substrate temperature, moisture content, ambient temperature and humidity, ventilation and conditions defined in manufacturer's written instructions for application of surface treatments, but not less than the following.
1. Minimum of 24 hours since last rain event, and a minimum of 8 hours of dry weather after completion of application.
 2. Surface temperatures at or above 40 degrees for minimum of 24 hours prior to application of surface treatments.
 3. Surface and air temperature between 40 degrees F and 95 degrees F.
 4. Maintain surface and air temperature above 40 degrees F for 8 hours after application.
 5. Provide manufacturer's recommended level of ventilation of enclosed areas during and after installation.
- C. Apply surface treatments in calm air conditions. Protect surfaces not intended to receive treatments.

PART 2 - PRODUCTS

2.01 LIQUID FLOOR TREATMENTS

- A. Liquid Concrete Repair Material: Low-order, liquid fill material used to fill pinholes, small air voids and pops, microcracks, and other minor flaws in concrete surface during surface grinding operation.
1. Basis-of-Design Product: PROSOCO Inc; Consolideck Grind-N-Fill.
- B. Pre-Densifier Concrete Cleaner: Non staining cleaner to remove dirt, oil, grease and other stains from existing slab surface. Chemically neutral, liquid cleaner with PH factor between 7 and 10, biodegradable and phosphate free.
1. Basis-of-Design Product: PROSOCO Inc; Consolideck Cleaner/Degreaser.
- C. Penetrating Concrete Hardener/Densifier: Clear, waterborne solution of lithium silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Basis-of-Design Product: PROSOCO Inc; Consolideck LS.
- D. Sealer: Clear penetrating sealer to repel and prevent stains from water or oil containing substances.
1. VOC: Maximum of 100 g/L.
 2. Basis-of-Design Product: PROSOCO Inc; LS Guard.

2.02 POLISHING DIAMOND HEADS

- A. Metal Diamond Heads.

1. Scanmaskin Baunta Metal Bond Tooling
 2. 40, 80 or 150 grit.
- B. Hybrid Diamond Heads
1. Cross Maxx.
 2. Blue Star Diamond (BSD) Ceramic.
 3. 50 or 100 grit.
- C. Resin Bonded, Phenolic Diamonds
1. Pro-Maxx Resin Bond Tooling.
 2. 100 or 200 grit.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate with representatives of concrete polishing contractor, Architect, and Owner. Identify and record in writing concrete substrate conditions detrimental to completing the work in accordance with the approved sample panel.
- B. Identify procedures to be followed to correct unsatisfactory conditions.
- C. Do not begin concrete polishing until detrimental conditions are corrected.
 1. Initiating concrete polishing constitutes acceptance of the concrete substrate.
 - a. Concrete polishing contractor accepts responsibility for correcting unacceptable work resulting from previously observed but uncorrected conditions.

3.02 PREPARATION

- A. Clean dirt, dust, oil, grease, and other matter that may interfere with penetration or performance of specified products. Use appropriate concrete cleaners approved by the concrete surface treatment materials manufacturer. Rinse rough slab thoroughly using pressure water spray to remove cleaner and residues.
- B. Repair, patch and fill cracks, voids, defects, and damaged areas in surface per demonstration of repairs made to accepted sample panel. Allow time for repairs to cure completely prior to application of surface treatment products.
 1. Variations in substrate texture and color can affect final appearance of work. Review changes in substrate or color with Architect and Owner prior to proceeding with application of consolidation treatments and polishing.
- C. Protect surrounding work, including adjacent CMU walls, un-polished slabs, metal, glass, painted surfaces, etc.
 1. Flush misapplied product from surfaces with water immediately prior to material drying.

- D. Clean dust and debris from saw cuts in slabs to be polished. Fill cuts with silica sand and approved epoxy joint filler. Color filler as directed by Architect. Complete application of filler prior to application of consolidation treatments and polishing.

3.03 POLISHING

- A. General: Follow industry standard polishing procedures for dry and wet grinding or polishing.
 - 1. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber machine between and after final polishing passes.
 - 2. Limit sequential progression of diamond polishing steps to no more than double the grit value of previous step.
 - 3. Overlap adjacent polishing passes by 25 percent.
 - 4. Perform each pass perpendicular to previous pass. Conduct multiple passes with each grit to achieve even appearance in slab with each step in grit.
 - 5. Utilize hand grinders or stand-up edger to finish slab edges and corners.
 - 6. Control and dispose of waste products produced by grinding and polishing operations.
- B. Utilize grinding and polishing equipment with a dust extraction system including HEPA filtration vacuums.
 - 1. Basis-of-Design Equipment: Scanmaskin with pre-separator.
- C. Diamond Heads: Use heads from same manufacturer throughout the approved

3.04 INITIAL GRINDING

- A. Progress through grinding steps utilizing submitted and approved diamond heads to remove surface fines. Expose aggregate over entire slab to match Sample Panel and meet finishing performance requirements.
 - 1. Estimated depth of grind: 1/4 inch (25 mm).
 - 2. Maintain concrete flatness specified throughout grinding steps.

3.05 LIQUID CONCRETE REPAIR MATERIAL

- A. Apply liquid concrete repair material by method recommended in manufacturer's written instructions.
 - 1. Apply in final steps of approved polishing step sequence.
 - 2. Verify grinding equipment is not connected to vacuum hose prior to application of liquid repair material.
- B. Apply liquid concrete repair material by spray or pour and spread with a soft push broom. Apply immediately in the grinding machine path, but no more than 10 feet beyond front of grinder. Saturate the floor without producing standing puddles.
- C. Grind the wet floor until surface of slab is dry. Grind treated areas prior to liquid repair material dries.

- D. Allow slab and liquid repair application to cure 12 hours prior to continuation of grinding and polishing of concrete.
- E. Reconnect grinder to vacuum prior to continuation of grinding and polishing.

3.06 PENTRATING CONCRETE HARDENER/DENSIFIER

- A. Apply after 200 grit grinding step and prior to 400 grit grinding step.
- B. Apply at rate of 500 to 700 square feet per gallon with a low-pressure sprayer fitted with 0.5 gallon per minute spray tip.
 - 1. Keep surface wet for 5 to 10 minutes, without causing puddles on slab.
- C. Allow treated surfaces to dry prior to continuing polishing sequence.

3.07 FINAL POLISH

- A. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
- B. Final Polish Sheen and Grit: Level 3: High sheen, 800 grit.

3.08 SEALER

- A. Neutralize and clean polished concrete surfaces.
- B. Apply sealer to clean, dry concrete after completion of final polish. Clean polished concrete surface per sealer manufacturer's written instructions.
- C. Apply saturating application at a rate of 400 to 800 square feet per gallon. Do not atomize sealer. Even puddles with microfiber applicator before material dries. Do not burnish slab with applicator.

3.09 FINAL CLEANING

- A. Clean ground concrete per chemical manufacturers instructions prior to occupancy.
- B. Provide clean slab surface, using manufacture approved concrete maintenance cleaner applied by auto-scrubber equipped with soft nylon brushes.
- C. Provide final burnish of interior concrete floor using burnisher generating minimum pad speeds of 1,500 RPM and equipped with dust skirts.
 - 1. Burnish with non-abrasive white burnishing pad recommended by protective treatment manufacturer.

3.010 FINISH REQUIREMENTS

A. Appearance.

1. Interior exposed finished slab to meet CPAA Class "D" large aggregate exposure classification and CPAA Level "2" finished satin gloss. Sheen to be consistent with approved Sample Panel.

B. Performance

1. Traction rating: "High Traction Range"; per ANSI B101.1
2. Coefficient of Friction: Greater than 0.60 dry and wet; per ASTM C1028.
3. Stain Resistance: Limited or no adverse effects; per ASTM D1038.
4. Water Vapor Transmission: 100 percent retained compared to untreated samples; per ASTM E96/96M Method B (Water Method).
5. UV Stability: No degradation or yellowing; per ASTM G154.

3.011 PROTECTION

A. Protect finished floor to prevent damage, including stains, gouges, scratches and other damage from ongoing construction traffic and activities.

1. Do not store or drag equipment, materials, fixtures, ladders etc. across the finished slab.
2. Inspect equipment tires and wheels for debris prior to crossing slab.
3. Remove spilled materials immediately. Provide proper cleaning and absorptive materials.

END OF SECTION 033543

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Cavity wall insulation adhered to masonry backup.
8. Accessories.
9. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

1. Section 044313.13 "Anchored Stone Masonry Veneer" for thin stone trim set as anchored veneer.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing reglets installed in masonry joints.
4. Section 321400 "Unit Paving" for exterior unit masonry paving.

1.02 DEFINITIONS

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

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.

D. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Cavity drainage material.
4. Accessories embedded in masonry.

1.05 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. Receipt of list does not constitute 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 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. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Qualification Statements: For testing agency.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.
- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- 1.06 QUALITY ASSURANCE
- A. Qualifications:
1. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.
- 1.07 MOCKUPS
- A. Wall Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Upon receipt of approved product data and shop drawing submittals, conduct meeting to review requirements and intent of mockup construction prior to building mockup. Include Contractor, Construction Engineer, Mason, Architect and Owner Representative.
 2. Build separate mockups for typical exterior limestone veneer cavity wall and typical interior ground face block wall in sizes approximately 64 inches (1625 mm) long by 48 inches (1219 mm) high by full thickness, including face and backup wythes, accessories, and stone copings for exterior wall mockup.
 - a. Construct mockup on platform that allows assembly to be moved to alternate locations on the site.
 - b. Include a sealant-filled joint at least 16 inches (406 mm) long in each mockup. Extend joint through the coping at exterior mockup.
 - c. Exterior wall mockup:
 - 1) Include lower corner of louver opening at upper corner of exterior wall mockup. Make opening approximately 16 inches (406 mm) wide by 16 inches (406 mm) high.
 - 2) Include base of wall and coping through-wall flashing installed for a 24-inch (610-mm) length at end of exterior wall mockup, with a 12-inch (305-mm) length of flashing left exposed to view.
 - 3) Include dampproofing, veneer anchors, flexible through wall flashing, drip edge and sealant stop metal edge flashings, cavity drainage material, and weeps in exterior masonry-veneer wall mockup.
 - d. Interior wall mockup.

- 1) Include decorative face CMU only for interior unit masonry wall mockup.
3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated. Use same methods and tools for removal of mortar and mortar stains as proposed for actual construction. Cleaning to be performed by individuals who will perform work on actual construction.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship
 - a. Approval of mockups is also for proper installation of other accessory materials and associated construction qualities specified in this section.
 - b. Mockup will be used for approval of materials required by other sections which depend upon proper execution of masonry installation.
 - c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations by Change Order.
 - d. Retain mockups on site and in condition at the time of their approval until acceptance of masonry construction.

1.08 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. If units are soiled, clean units and do not install until they are dry and accepted for installation by Architect.
- 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 preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store and protect masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 FIELD 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 (610 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 (610 mm) 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 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.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.
 - 1. Do not clean masonry with acidic cleaner when temperatures are forecasted to be at or above 90 degrees during cleaning operations.
 - 2. Do not clean dark colored masonry with acidic cleaner when it is in direct sunlight.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

- A. Obtain each of the following, from single source, producer or manufacturer.
 - 1. Each type of exposed masonry units.
 - 2. Cementitious mortar components
 - 3. Mortar aggregate.
- B. For exposed color masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.02 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) in accordance with TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.03 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units with defects where such defects are exposed in the completed Work.

2.04 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 bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent.
 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ACM Chemistries; RainBloc.
 - 2) GCP Applied Technologies Inc.; Dry-Block Block Admixture.
 - 3) Master Builders Solutions; MasterPel 240.
- C. CMUs: ASTM C90, normal weight.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
 2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.
- D. Decorative CMUs: ASTM C90, normal weight.
 1. Basis-of-Design Product: Subject to compliance with requirements, Consumers Concrete Corporation Permagrind or comparable product by one of the following:
 - a. Echelon; Trendstone.
 - b. Westbrook Concrete Block; Ground Face Masonry.

c. York Building Products; Gemstone.

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
4. Pattern and Texture: Standard pattern, ground-face finish.
5. Colors: Match Architect's samples,, equal to Consumer Concrete Corporation Permagrind "Domino".

2.05 LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Holcim (US) Inc; Rainbow Mortamix Custom Color Masonry Cement.
 - b. Lafarge North America Inc.; Magnolia Masonry Cement.
 - c. Lehigh Hanson; Heidelberg Cement Group; Lehigh Masonry Cement.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Solomon Colors Inc.
- F. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 2. Pigments do not exceed 5 percent of masonry cement by weight.
- G. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- H. Aggregate for Grout: ASTM C404.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ACM Chemistries; RainBloc for mortar.
 - b. GCP Applied Technologies Inc.; Dry-Bloc Mortar Admixture.
 - c. Master Builders Solutions; MasterPel 240MA or MasterPel 210D.
- K. Water: Potable.

2.07 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon for ladder or truss, stainless steel for veneer ties.
 3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
 7. Provide in lengths of not less than 10 ft. (3 m), with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.6 mm) and maximum vertical adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.

2.08 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 1. Stainless Steel Wire: ASTM A580/A580M, Type 304 or Type 316.
 2. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
 1. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
 2. Wire: Fabricate from 3/16-inch- (4.76-mm-) diameter, stainless steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, mill-galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.4-mm-) diameter, mill galvanized steel wire.
- E. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (10-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.09 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch (0.40 mm) thick.
 2. Fabricate continuous flashings in sections 96 inches (2438 mm) long minimum, but not exceeding 12 ft. (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.

3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 3/4 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed. Refer to detail in Drawings.
 5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall. Set stop minimum 5/8 back from exterior face of wall, bend metal back on itself and up into joint 1/4 inch (6.4 mm) to form a stop for retaining sealant backer rod. Refer to detail in Drawings.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Fabric Flashing: 5 oz./sq. ft. (1.5 kg/sq. m) self-adhesive copper sheet bonded between two layers of glass-fiber cloth.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Copper Sealtite 2000.
 - 2) Hohmann & Barnard, Inc; Copper Fabric Flashing SA.
 - 3) Wire-Bond; Copper Seal Flashing #4140.
 - 4) York Manufacturing, Inc; Multi-Flash 500.
 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mil (1.0 mm).
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Strip-N-Flash.
 - 2) Carlisle Coatings & Waterproofing Inc; CCW-705-TWF Thru-Wall Flashing.
 - 3) Fiberweb, a brand of Clark/Hammerbeam Corp.; Aquaflash 1000.
 - 4) GCP Applied Technologies Inc.; Perm-A-Barrier Wall Flashing.
 - 5) Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 6) Hohmann & Barnard, Inc; HB Below-Grade 60.
 - 7) Polyguard Products, Inc.; Polyguard 400.
 - 8) Williams Products, Inc.; Everlastic MF-40.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
 - C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
 - D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
 - E. Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches (0.48 mm by 38 mm) or Aluminum sheet 0.064 inch by 1-1/2 inches (1.63 mm by 38 mm) with a 3/8-inch (10-mm) flange at top and bottom.

2.010 CAVITY-WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.011 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vents: Use the following unless otherwise indicated:
 - 1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch (6.4 to 10 mm) in diameter, in length required to produce 2-inch (51-mm) exposure on exterior and 18 inches (457 mm) in cavity. Use only for weeps.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Mortar Deflector: Strips, full depth of cavity and minimum of 10 inches (254 mm) high, with dovetail-shaped notches that prevent clogging with mortar droppings.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Break DT.
 - 2) Hohmann & Barnard, Inc; Mortar Trap.
 - 3) Mortar Net Solutions; Wall Defender.
 - 4) Wire-Bond; Cavity Net DT.
 - 5) York Manufacturing, Inc; Weep-Net™.
- F. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new

masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. PROSOCO, Inc.

2.012 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. For exterior masonry veneer, use masonry cement mortar.
 3. For reinforced masonry, use portland cement-lime or masonry cement mortar.
 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, 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 S.
 2. For reinforced masonry and interior or exterior load bearing walls, use Type S.
 3. For above-grade, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 4. For limestone veneer, use Type N, maximum air content of 14%.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 1. Pigments do not exceed 5 percent of masonry cement by weight.
 2. Mix to match Architect's sample.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Limestone Veneer
 - b. Ground Face Block
- E. Grout for Unit Masonry: Comply with ASTM C476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 3000 psi (21 MPa).
 3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.01 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 the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Verify door frame hardware preparations and fastener locations are protected by grout boxes or foam insulation and raceways for electrified hardware is in place prior to grouting door frame jambs full.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite 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 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. Mix units from several pallets or cubes as they are placed.

3.03 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 (13 mm) or minus 1/4 inch (6.4 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) 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 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) 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 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) 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 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3.2 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.6 mm) from one masonry unit to the next.

3.04 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 CMU Masonry: Unless otherwise indicated, lay exposed CMU masonry in running bond; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel or fiberglass frames and masonry solidly with mortar unless otherwise indicated.

- F. 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.
- G. Fill cores in hollow CMUs with grout 24 inches (610 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build nonload-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 (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1219 mm) o.c. unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 - 1. Bed face shells in mortar and make head joints slushed full.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- 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. Set stone as specified in section 044313.13 "Anchored Stone Masonry Veneer".
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush where indicated to receive dampproofing, cavity wall insulation, and unless otherwise indicated.

3.06 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 - 1. Individual Metal Ties: Provide adjustable-type (two-piece-type) ties as indicated installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (914 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

2. Masonry-Joint Reinforcement: Adjustable-type (two-piece-type) reinforcement installed in horizontal mortar joints.
- B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together using one of the following:
1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
 2. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.07 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
1. Masonry-Joint Reinforcement: Adjustable-type (two-piece-type) reinforcement installed in horizontal mortar joints.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing".
- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (305 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.
1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.08 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (152 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) 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.

3.09 ANCHORING MASONRY TO STRUCTURAL STEEL

- A. Anchor masonry to structural steel, where masonry abuts or faces structural steel, to comply with the following:
 - 1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and welded to structural steel.
 - 3. Space anchors not more than 16 inches (406 mm) o.c. vertically.

3.010 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.

3.011 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where indicated and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are indicated without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (203 mm) at each jamb unless otherwise indicated.

3.012 FLASHING AND WEEPS

- A. General: Install embedded flashing, cavity drainage material and weep ropes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. Application: Unless otherwise indicated, use the following: Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.

3. At the base of masonry walls, where flashing is partly exposed and is indicated to terminate at the wall face, use flexible flashing with a metal drip edge.
4. At lintel through wall flashing, use flexible flashing with a metal sealant stop.
5. For through wall flashing under coping stones, provide metal sealant stop on outside face of wall, and metal drip edge on roof side of wall.
6. Where flashing is fully concealed, use flexible flashing.

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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (203 mm), and 1-1/2 inches (38 mm) into the inner wythe. Form 1/4-inch (6.4-mm) hook in edge of flashing embedded in inner wythe.
3. At lintels and shelf angles, extend flashing 6 inches (152 mm) minimum at each end. At heads and sills, extend flashing 6 inches (152 mm) minimum and turn ends up not less than 2 inches (51 mm) to form end dams.
4. Install metal drip edges beneath flexible flashing at exterior face of wall at the base of (ground level) of face brick and on roof side of coping through wall flashing. Stop flexible flashing 3/4 inch (19 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
5. Install metal sealant stop flashing termination beneath flexible flashing at exterior face of limestone veneer at lintels, outside face of coping through wall flashing, and other openings in limestone. Stop flexible flashing 3/4 inch (19 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
6. Install metal flashing reglets to receive counter flashing beneath flexible flashing at roof terminations.

C. Install reglets for flashing and other related construction where they are indicated to be built into masonry.

D. Install weeps in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep 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 formed from wicking material 16 inches (406 mm) o.c.
4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.013 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie,

- and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches (1524 mm).
- 3.014 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. 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 will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level B in TMS 402-11.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.
1. Test mortar for limestone veneer for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.015 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.
 - a. Architect will recommend Owner refuse payment for masonry cleaned with metallic tools.
 - 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 concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 6. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.
 - 7. Clean limestone veneer as specified in section 044313.13 Anchored Stone Masonry Veneer.

3.016 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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches (102 mm) in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
 - 3. Do not dispose of masonry waste as fill within 18 inches (457 mm) of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 044313.13 - ANCHORED STONE MASONRY VENEER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Stone masonry anchored to unit masonry backup.

B. Products Installed but Not Furnished under This Section Include:

1. Steel lintels in stone masonry.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for mortar, concealed flashing, horizontal joint reinforcement and veneer anchors.

1.02 PREINSTALLATION MEETINGS

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

1.03 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples for Verification:

1. For each stone type indicated. Include at least four Samples from separate quarry blocks in each set and show the full range of color and other visual characteristics in completed Work.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. List of Materials Used in Constructing Mockups: Provide stone information for list as required in section 042000 Unit Masonry.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than

abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution. Reference section 042000 "Unit Masonry" for additional information.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials aggregates, preblended material and accessories as required by 042000 "Unit Masonry".

1.07 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Cold-weather cleaning is not permitted.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in section 042000 "Unit Masonry".

1.08 COORDINATION

- A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.02 LIMESTONE

- A. Material Standard: Comply with ASTM C568/C568M.
 - 1. Classification: II Medium Density.
- B. Description: Oolitic limestone.
- C. Varieties and Sources: Indiana limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.
 - 1. Indiana Limestone Grade and Color: Select, gray, according to grade and color classification established by ILI.
- D. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.03 MORTAR MATERIALS

- A. As specified in section 042000 "Unit Masonry".

2.04 VENEER ANCHORS

- A. As specified in section 042000 "Unit Masonry".

2.05 STONE COPING ANCHORS

- A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or post installed anchor bolts for fastening to substrates or framing as indicated.
- B. Materials: Fabricate dowels from stainless steel, ASTM A276, Type 304 OR Type 316.

2.06 EMBEDDED FLASHING MATERIALS

- A. As specified in section 042000 "Unit Masonry".

2.07 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. PROSOCO, Inc.

2.08 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. Saw stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
 - 1. Shape stone specified to be laid in ashlar pattern indicated in Drawings.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors and supports.
- E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.
- F. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - 1. Thickness: 4 inches (100 mm) plus or minus 1/4 inch (6 mm).
- G. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.
 - 1. Finish: Smooth sawn.
 - 2. Finish for Copings: Smooth.
 - a. Finish exposed ends of copings same as front and back faces.

2.09 MORTAR MIXES

- A. Comply with requirements in section 042000 "Unit Masonry".

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Examine substrate to verify that dampproofing, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coat concrete and unit masonry backup with dampproofing specified in section 071113 "Bituminous Dampproofing".
- B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.03 INSTALLATION OF STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in ashlar pattern with continuous course heights as indicated, lengths, and uniform joint widths, with offsets between vertical joints as indicated.
- D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- E. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.
- F. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- G. Install steel lintels where indicated. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

- H. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch (6 mm) at narrowest points or more than 3/8 inch (10 mm) at widest points.
- I. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealant joints are specified in Section 079200 "Joint Sealants."
- J. Install embedded flashing and weep ropes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. Comply with requirements in Section 042000 "Unit Masonry."
- K. Place weeps in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
 - 1. Use wicking material .
 - 2. Space weep holes formed from wicking material 16 inches (400 mm) o.c.
 - 3. Trim wicking material used in weeps flush with exterior wall face after mortar has set.

3.04 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.05 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry. Comply with requirements in section 042000 "Unit Masonry".

- B. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches (38 mm), through stone masonry and with at least a 5/8-inch (16-mm) cover on exterior face.
- C. Provide 2-inch (50-mm) cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
 - 2. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.06 INSTALLATION OF STONE COPINGS AND TRIM BELOW COPING

- A. Set copings in mortar bead joints and with unfilled (open) head joints or head joints filled with compressible gasket material. Prepare coping joints for installation of joint sealants.
 - 1. Use setting buttons, stainless steel or non-metallic shims to maintain bed joint dimension.
 - a. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
 - b. Bearing Pads: Strips of plastic, Type A Shore durometer hardness of 70 to 80, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.
 - 2. Rake bed joint to a depth of not less than 1/2 inch (12 mm) from face of stone. Rake joint to a uniform depth with square bottoms and clean sides. Clean excess mortar from head joints.
 - 3. Set or cut top and side edges of head joint gasket material back 1/2 inch (12 mm) from face of stone.
 - 4. Provide sealant and backer rod in coping joints per requirements of Division 7, Section "Joint Sealants".

3.07 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Concave.

3.08 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 2. Defective joints.
 3. Stone masonry not matching approved samples and mockups.
 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
1. Remove large mortar particles by hand with wooden paddles..
 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 5. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.09 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Generally, retain subparagraph below. If required, increase limit if using acid-soil plants for foundation plantings.
 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.13

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, services, connection design, and equipment necessary for the complete fabrication and erection of all structural steel as detailed on the Structural Drawings and as specified herein. Section also includes any supplementary parts and members required to erect the structural steel and decking regardless of whether such parts and members are indicated by the final design. Include miscellaneous deck support angles as required for proper support of steel floor deck around columns, gussets, openings and obstructions. Section includes furnishing and installing the non-shrink grout beneath the structural steel.
- B. Contractor coordination with MEP trades for exact dimensions of framing around penetrations and equipment support layout where necessary prior to shop drawing production.

1.2 WORK FURNISHED BUT NOT INSTALLED

- A. Anchor rods and other embedded connection components.
- B. Loose Lintels

1.3 RELATED SECTIONS

- A. Steel Roof Deck - Section 05 31 00
- B. Miscellaneous and Architectural Metal - Division 05
- C. Loose lintels are furnished Miscellaneous Metals Section – Division 05.
- D. Painting and Finishes – Division 09

1.4 REFERENCES

- A. Work on this project shall conform to all requirements of the latest version of the specifications listed below adopted by the applicable version of the building codes for this project except where modified by these contract documents. Refer to Design Information Drawing for applicable versions of Building Codes.

ASTM specifications apply in their entirety where specifically referenced in the body of this section.

Refer to specific portions of other guides, guidelines, and manuals where referenced in the body of this specification section.

- 1. AISC 360 - Specification for Structural Steel Buildings
- 2. AISC 303-16 - Code of Standard Practice for Steel Buildings and Bridges (Sections 3.3 and 4.4 are excluded.)

3. RCSC "Specification for Structural Joints Using High Strength Bolts".
4. AWS "Structural Welding Code D1.1".
5. Steel Structures Painting Council Specifications SSPC.
6. AWS "Structural Welding Code - Reinforcing Steel", D1.4.

1.5 QUALITY CONTROL

A. Fabricator Qualifications

1. Experience: No less than five projects experience of comparable tonnage and complexity with a record of successful performance in fabrication of structural steel with scope similar to this project.
2. AISC Certification for Structural Steel Fabricators: Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components (AISC 207). No portions of the Work shall be subcontracted to non-certified facilities unless the welds and connections by the non-certified facility are tested and inspected through the certified facility's QA/QC program.
3. Engineering: Connections designated for delegated design shall be designed under the supervision of a licensed professional engineer registered in the state in which this project occurs with experience in five projects of similar scope and complexity.

B. Erector Qualifications

1. Experience: No less than five projects experience with a record of successful in-service performance in erection of structural steel buildings of type and scope similar to this project.
2. Provide continuous erection supervision, by superintendent with no less than ten years of experience in erection of structural steel buildings of type and scope similar to this project.
3. AISC Certification for Structural Steel Erectors: Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components (AISC 207). No portions of the Work shall be subcontracted to non-certified erectors.
4. Engineering: No less than five similar projects experience by erection engineer with a record of successful completion. Erection engineer shall be licensed in the state where this project is located.

C. Welding: all welders both in the shop and field shall be certified under AWS D1.1, "Standard Qualification Procedure" for the types of welding being performed and shall have been continuously engaged in such welding. Certification shall remain in effect for the duration of the work. Certification of welding personnel is subject to verification by the Testing and Inspection Agency.

D. Engineer of Record's submittal review does not relieve the Contractor of their responsibility for any errors in detailing, fabrication, erection and fit up.

E. Field Surveys

1. Prior to fabrication: Contractor is to provide survey to field verify locations and elevations of anchor rods and all embeds to receive structural steel attachments.

F. Verify fit up at truss splices in the shop prior to delivery to the site.

G. See mockup requirements for AESS in “Submittals” section below.

H. Contractor is to attend designer’s pre-detailing conference shortly after awarding of contract. Attendees shall include Construction Manager, General Contractor, Fabricator, Detailer, Connection Engineer and Erector.

1.6 PERFORMANCE REQUIREMENTS – DELEGATED DESIGN

A. All connections not fully detailed on the structural drawings shall be designed by the steel fabricator in accordance with the AISC Manual of Steel Construction consistent with the member design.

B. Unless otherwise noted, beam connections shall be simple connections.

C. Delegated connection design shall comply with Building Code requirements to resist the loads and criteria provided in the design Drawings and Specifications. Connection details provided are for general reference of connection geometry and restrictions but not intended to show actual number of bolts, weld sizes, stiffener sizes or gusset plate sizes required for connections subject to delegated design.

D. Select connection types and erection methods that will result in fit up within acceptable tolerances. Prior to shop drawing production, review design Drawings and Specifications for constructability and propose revisions that may be required to ensure fit up within acceptable tolerances. Submittal of shop drawings indicates Contractor is capable of providing fit up within acceptable tolerances using the submitted shop drawings.

E. Do not mix bolt grades of the same diameter on project. Use either ¾” and 1” diameter grade A325 bolts for all connections or ¾” diameter grade A325 and 1” diameter grade A490, if 1” diameter grade A325 are not adequate for the worst case. Do not use greater than 1” diameter bolts unless absolutely required.

F. Slip critical bolts shall be designed based on Class A surfaces.

G. Use plate washers for bolts with slotted and oversized holes.

1. Use 5/16” thick plate washers for long slotted holes

H. The steel supplier shall design the connections for the reactions indicated on the framing plans. Where reactions are not given, the connections for non-composite beams shall be designed for 50% of the total allowable uniform load on the span.

- I. Connection angles shall be 5/16" in thickness (minimum).
- J. Minimum connection strength shall not be less than that of two 3/4" diameter Grade A325 bolts.
- K. Beam connections shall consist of double web angles unless detailed otherwise on the drawings.
- L. Skewed shear connections shall consist of double bent plates unless the angle between the intersecting webs is less than 70°.
- M. The design of single plate shear connections shall conform to the current AISC Manual of Steel Construction. Use standard holes in standard configured single plate shear connections with bearing bolts unless specifically noted otherwise. Design extended shear plate connections for all eccentricities, using standard holes, assuming the pin is located at the supporting member centerline.
- N. Column Base Plates: Hole sizes for anchor rods may be oversized in accordance with the AISC Manual Table 14-2 to facilitate erection. Use plate washers under nut at all oversized holes as well as underneath base plate where leveling nuts are used. Washer thickness shall be at least 1/3 of bolt diameter.
- O. Sub base (leveling) plates under column base plates will not be permitted.
- P. Design truss and bracing connections for forces indicated on drawings. Provide connection configuration such that net section stresses of members do not exceed allowable stresses.
- Q. The stability of the structure and individual members during the erection process shall be checked by the Erector or their Engineer, in accordance with the AISC Code of Standard Practice.
- R. Design temporary bracing where required to erect the structural steel frame, until complete gravity and lateral system for final condition is installed. Coordinate schedule with Construction Manager and/or General Contractor and design temporary bracing and shoring to resist loads resulting from the performance of work by others when necessary. Design for temporary loads imparted by wind loads on cladding and interior partitions when dictated by project schedule.
 - 1. Note: Leaning center wall is designed to be supported by full, completed structural steel frame and lateral support provided by roof deck and CMU walls. Temporary shoring of center wall steel shall remain in place until all steel, roof deck, and CMU walls are in place including final connections.

1.7 SUBMITTALS

A. INFORMATIONAL SUBMITTALS

- 1. QUALIFICATIONS: Documentation indicating compliance with required fabricator and erector qualifications within 24 hours of bid.

2. SURVEYS:
 - a. Provide documentation for record only prior to fabrication indicating anchor rod and embed placement are within allowable tolerances.
 - b. Provide documentation for record only prior to elevated concrete slab placement indicating structural steel frame has been erected within allowable tolerances.
 3. CERTIFICATIONS:
 - a. Provide certification for all welders used in field and shop work for review by the Owner's Testing and Inspection Agency.
 - b. Submit Welding Procedure Specifications (WPS) in accordance with AWS D1.1 for all welded joints for review by the Owner's Testing and Inspection Agency.
 4. TEST REPORTS: Submit current ES Reports, by ICC Evaluation Service, Inc. for all non-standard post installed anchors. See Part 2 of this specification section for standard post installed anchors.
 5. PRODUCT INFORMATION:
 - a. Submit product information for products specified in Part 2 of this specification section under the provisions of Division 1 and demonstrating compliance with specified requirements.
 - b. Mill certification reports for record only for each type of structural steel and requiring charpy V notch test results.
 - c. Certification that welding electrodes meet Charpy toughness requirements when required.
 6. ENGINEERED ERECTION PLAN: Submit stamped erection sequencing plan, erection temporary bracing, shoring, and procedures for record.
- B. ACTION SUBMITTALS:
1. SUBMITTAL SCHEDULE
 - a. Submit proposed submittal schedule for review by designer prior to submitting any shop drawings or calculations for review. Include estimated number of sheets for each submittal. Submit shop drawings and calculations only in conformance with mutually agreed upon schedule. Allow for at least 15 working days for engineer's review of shop drawings and connection calculations from time of receipt by engineer to time of return by engineer plus delivery and transmittal times by other parties before and after.
 - b. Consolidate submittal schedule with joists and decking submittals.
 - c. See CALCULATIONS FOR DELEGATED DESIGN CONNECTION for required schedule for connection calculations.
 - d. Submit any requests for alternative connection details that vary from contract documents in advance with associated cost savings or schedule improvements.

2. SHOP DRAWINGS

- a. Shop drawings shall be submitted to the Engineer for review. Shop Drawings shall include erection plans and framing elevations, all shop and erection details including copes, connections, threaded fasteners, and welds. Shop drawings shall be reviewed and stamped with review stamp by connection designer for conformance to their design prior to submittal to engineer.
- b. Erection plans shall clearly denote locations of all connections which require field welds, slip critical bolts, and any bolts other than $\frac{3}{4}$ " diameter A325, if specified.
- c. Erection details with post installed anchors shall include diameter, embed depth and material grade for rods and system to be used.
- d. Use standard AWS symbols for welds, indicating size, length and type. Distinguish between shop and field welds. Provide prequalified weld designations and appropriate details including root opening dimensions, bevel properties and access hole dimensions for complete joint penetration and partial joint penetration groove welds.
- e. Provide setting drawings, templates and directions for installation of anchor rods and other devices.
- f. Shop drawings shall include the grade of steel, connection bolt and anchor rod material types, and the type of welding rods.
- g. Indicate provided capacities of shear connections at each end of each beam on the piece details sheets versus required shear capacities.
- h. Provide coordinated and consolidated steel anchor rod and embed placement drawings for each pour. Show embed details and locations for all anchor rods and embedments to be placed in concrete for trades including, but not limited to structural steel, cladding back up, malleable wedge inserts for masonry shelf angles, curtain wall, precast attachments, interior partitions, rollup doors, handrails, stairs and elevators. Consolidate into a single drawing for each pour to be used solely for this purpose. Reproductions of structural drawings shall not be used.
- i. Clearly indicate all AESS steel components and associated requirements on erection and fabrication drawings.
- j. Resubmitted shop drawings
 - 1) All information, which is correct on the original submittal, will not be changed in any way on the resubmitted shop drawings.
 - 2) If information on a shop drawing must be changed due to a Change Order, then all the changes must be clouded on the resubmitted shop drawings.
- k. Shop drawing action codes
 - 1) Shop drawings marked "Reviewed" do not require a resubmittal. Fabrication may commence.
 - 2) Shop drawings marked "Reviewed with exceptions" require the marked corrections to be made. No resubmittal is required. Fabrication may commence leading to steel erection once all exceptions noted are corrected.
 - 3) Shop drawings marked "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may not commence.

- 4) Shop drawings marked both "Reviewed with Exceptions" and "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may commence. Installation may not begin until the subsequent submission has been reviewed and returned.
- 5) Shop drawings marked "Rejected" must be resubmitted prior to any further review being completed.

I. CALCULATIONS FOR DELEGATED DESIGN CONNECTIONS

- 1) Submit sample calculations for each type of connection prior to submitting full calculation package.
 - 2) After sample calculations have been reviewed by the Engineer of Record and any comments addressed by the Connection Design Engineer, submit full calculation package.
 - 3) Calculations are required for connections not fully detailed on the Structural Drawings and not covered by AISC tables. Specifically, these include:
 - a) Truss panel connections.
 - b) Truss end connections.
 - c) Truss splices.
 - d) Column splices.
 - e) Moment connections.
 - f) Bracing connections.
 - g) Skewed shear connections.
 - h) Single plate shear connections or other shear connections not covered by AISC tables.
 - i) Shear connections with combined axial load.
 - j) Hanger connections
 - 4) Connection calculations are not required for shear connections that can be selected by an experienced detailer from standard AISC connection tables.
 - 5) Calculations shall be sealed by a Professional Engineer registered in the state in which this project is located.
 - 6) Connection calculations shall be clearly cross-referenced with individual beam marks and shop drawing sheet numbers.
 - 7) Connection Design Engineer shall review shop drawings for compliance to their design prior to submitting to the Engineer of Record.
3. AESS MOCKUPS: A mockup shall be provided for each type of component with designated categories AESS 3, AESS 4 and AESS C.
- a. Mockups shall be full size unless architect approves smaller models.
 - b. Demonstrate all applicable AESS characteristics for specified AESS category.
 - c. The mockup shall demonstrate weld quality and contouring as well as specified surface prep and prime coating with finish coat.

1.8 DELIVERY, STORAGE & HANDLING

- A. Exercise care in handling, storing and erection of structural steel to avoid damage to pieces, welds, joints and paint. Secure pieces against displacement in transit.
- B. Structural steel members, which are stored at the job site, shall be stored above ground on platforms, skids or other supports. Protect with weatherproof cover held in place.
- C. Clean members, which have become soiled before erecting.
- D. Anchor rods and other anchorage devices, which are embedded in cast-in-place concrete, shall be delivered to the project site in time to be installed before the start of concrete operations.
- E. AESS. All tie-downs on loads shall be nylon straps or chains with softeners to avoid damage to edges and surfaces of members.
- F. The erector shall use special care in unloading, handling and erecting AESS to avoid marking or distorting the AESS. The erector shall plan and execute all operations in such a manner that allows the architectural appearance of the structure to be maintained:
 - 1. Slings shall be nylon-type or chains or wire rope with softeners.

1.9 SEQUENCING

- A. Supply anchorage items to be embedded in concrete or attached to other construction without delaying the Work.
 - 1. Furnish all anchor rods for anchorage of structural steel at an advance date for incorporation into the concrete foundation by others.
 - 2. Provide setting diagrams, templates, instructions, as required for installation.
 - 3. Do not install columns on anchor rods until concrete is demonstrated to have attained the required 28-day compressive strength.
 - 4. Install grout beneath column base plates prior to erecting structural steel framing above where anchor rods are not adequate alone to resist dead loads of steel framing alone. Otherwise, grout must be installed prior to placing slabs above.
- B. Do not remove temporary shoring or bracing until all framing that makes up the completed structural system has been installed and connected. This includes:
 - 1. All framing and connections
 - 2. Metal roof deck and attachments to structure
 - 3. Elevated slabs
 - 4. Masonry shearwalls

The Erector and General Contractor are responsible for the stability and safety of the partially erected structure.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. W-Shapes: ASTM A992
- B. Channels: ASTM A36
- C. Angles: ASTM A36, or ASTM A572 Grade 50 and ASTM A992 where specifically noted.
- D. Plates and Bars: ASTM A572 Grade 50 up to 4" thick and ASTM A36 for plates thicker than 4"
- E. Rectangular and Square HSS: ASTM A500, Grade C, $F_y = 50$ ksi.
- F. Structural steel pipe: ASTM A53, Type E or S, Grade B, $F_y = 35$ ksi or ASTM A501, $F_y = 36$ ksi.
- G. Round HSS members: ASTM A500, Grade C, $F_y = 46$ ksi.
- H. Connection bolts:
 - 1. ASTM F3125 Grade A325 Type 1 for bearing, pretensioned and slip critical joints.
 - 2. ASTM F3125 Grade A490 Type 1 for bearing, pre-tensioned and slip critical joints where 1-inch diameter Grade A325 bolts are inadequate for connection design.
 - 3. Hot dip galvanized ASTM F3125 Grade A325 Type 1 in accordance with ASTM F2329 for bearing, pre-tensioned and slip critical joints where noted on the drawings.
 - 4. Tension Control Bolts: ASTM F1852 and ASTM F2280
 - 5. Mechanically galvanized ASTM F1852 in accordance with ASTM B695 where noted on the drawings.
 - 6. TC (Tension Control) Bolts will not be allowed in bearing type connections.
- I. Anchor rods: ASTM F1554, Grades 36, 55 or 105 as indicated. Provide galvanized rods, nuts and washers for applications subject to exterior or exposed unconditioned environments.
- J. Nuts: ASTM A563 or ASTM A194: All nuts shall have a minimum Rockwell core hardness of C25 for Grade A325 bolts and C33 for Grade A490 bolts.
- K. Washers: ASTM F436, or ASTM A36 plate washers for slotted and oversized holes.
- L. Galvanize nuts and washers where indicated on the drawings in accordance with ASTM F2329 (hot dipped) or ASTM B695 (mechanical)
- M. Fabricator shall review material test reports for materials taken from stock (fabricators shop or warehouse) and verify conformance to the above specifications. Stock materials purchased under no particular specification, or under a specification that is less rigorous than applicable ASTM specifications shall not be used.

N. Welding rods:

1. AWS E70XX for A36 steel.
2. AWS E70XX low hydrogen for Grade 50 steel welded by SMAW process.
 - a. Only electrodes or electrode-flux combinations capable of depositing weld metal with a maximum diffusible hydrogen content of 8 mL/100g (H8) are permitted.
3. Filler material shall meet Charpy requirements of 20 ft-lbs or greater @ 40° F for CJP welds at T and corner joints as well as butt splices of heavy sections or plates 2" or greater in thickness.

O. Post Installed Expansion Anchors:

1. Expansion anchor shall have an ES Report demonstrating the anchor has met the requirements of AC193 for mechanical anchors as specified by the International Code Council (ICC) and meet the requirements of ACI 355.2.
2. Use stainless steel anchors for conditions subject to exterior exposure.
3. Standard for fastening to concrete:
 - a. Hilti Kwik Bolt KB-TZ2 by Hilti Fastening Systems.
4. Information shown on structural drawings:
 - a. Diameter
 - b. Finish
 - c. Minimum embedment in concrete
 - d. Ultimate tension capacity for testing purposes

P. Post Installed Adhesive Anchors:

1. Adhesive anchors shall have an ES Report demonstrating the anchor had met the requirements of AC308 for adhesive anchors as specified by ICC and meet the requirements of ACI 355.4.
2. Adhesive anchors shall be supplied as an entire system. The system shall include, but is not limited to, Manufacturers Printed Installation Instructions (MPII) as supplied with the adhesive, adhesive cartridge, mixing nozzle, extension tube, dispenser, and all required equipment for properly cleaning the drilled hole.
3. Use stainless steel rods for conditions subject to exterior exposure.
4. Standards for fastening to concrete:
 - a. Hilti HY-200 V3 by Hilti Fastening Systems
 - b. Rod Material Grade 55 unless noted otherwise.
5. Standards for fastening to masonry:
 - a. Hilti HY-270 by Hilti Fastening Systems.
 - b. Rod Material Grade 55 unless noted otherwise.
6. Information shown on structural drawings:

- a. Diameter
 - b. Finish
 - c. Minimum embedment in concrete
 - d. Ultimate tension capacity for testing purposes
- Q. Headed studs (used as anchor studs or as shear connectors): ASTM A108.
1. Standards:
 - a. KSM Fastening Systems, Omark Industries
 - b. Nelson Stud Welding, TRW Nelson Division
 - c. Blue Arc Welding Studs, Erico Products
 2. The use of manually welded anchors, rods, bars, straps, or reinforcing bars is not acceptable as a substitute for headed studs or deformed bar anchors.
- R. Deformed bar anchors: ASTM A496.
1. Standards:
 - a. KSM Fastening Systems, Omark Industries
 - b. Nelson Stud Welding, TRW Nelson Division
 2. The use of manually welded anchors, rods, bars, straps, or reinforcing bars is not acceptable as a substitute for headed studs or deformed bar anchors.
- S. Non-Shrink Grout:
1. Grout shall be prepackaged requiring only the addition of potable water.
 2. Grout shall not contain metallic substances or aluminum powder.
 3. Grout shall attain compressive strengths per ASTM C-1107.
 4. Grout shall meet the dimensional stability requirements of ASTM C-1107, Grade C, when prepared according to the manufacturer's instructions and tested at 40°F and 90°F.
 5. Grout shall be capable of maintaining a flowable consistency for a minimum of 45 minutes at 70°F.
 6. Do not retemper grout after initial mixing.
 7. Standards:
 - a. Five Star Grout; Five Star Products, Inc.
 - b. Master Flow 100 by Master Builders Solutions
 - c. SonogROUT 10k by Sonneborn
- T. Shop primer: See Article 2.3
- U. AESS Surface Repairs: Two-part-metal reinforced body filler.

2.2 FABRICATION

- A. Fabricate structural steel in accordance with AISC-360 and AISC-303 except where modified or amended in this Specification Section.
- B. Trusses:
 - 1. See performance requirements for connection design and fabricate connections accordingly.
 - 2. See Quality Assurance paragraph of this specification section for fit-up requirements.
 - 3. Fabricate within AISC-303 tolerances, except as modified below.
 - a. Length measured in shop of fabricated portion of truss between supports: $\pm 1/8"$.
 - b. Height measured in shop of fabricated trusses: $\pm 1/8"$.
 - c. Measured camber in shop: $+ 1/2-0$ from specified camber.
 - d. Measured sweep in shop: .0125 of truss length or .0125 of cantilever length.
 - e. Out of straightness shall not, except $1/8"$ in 10 feet.
 - f. Measured twist in shop: 0.10 degrees in 40 feet.
 - 4. For trusses detailed without specified camber, components shall be fabricated so that, after erection, any incidental camber in the truss is upward.
- C. Shop connections shall be welded or bolted with $3/4"$ diameter Grade A325 bolts where practical. See PART 1 - GENERAL - PERFORMANCE REQUIREMENTS for use of other bolts in connections.
- D. Welding shall be accomplished by welders certified for weld types and positions involved according to the "Structural Welding Code" AWS D1.1.
- E. Connections:
 - 1. See Performance Requirements article of this specification section for design and minimum material requirements for connections.
 - 2. See Quality Assurance article of this specification section for fit-up requirements.
 - 3. Penetrations, copes, and weld access holes:
 - a. Drill or punch holes perpendicular to surface.
 - b. Do not flame cut or enlarge holes by burning.
 - c. Drill holes in bearing plates and base plates.
 - d. Access holes and copes shall be clean cut without torn or ragged edges and meet the surface requirements of Chapter M of AISC-360, 2000 micro-inches max as defined in ASME B46.1. Heavy sections shall be preheated prior to thermal cutting.
 - 4. Splicing of members in the shop or in the field is prohibited without prior approval of the engineer.

5. Skewed shear connections with double bent plate: Take special care to avoid cracking of bent plate. Bend plates perpendicular to rolling direction. Bill with the width dimension parallel to the bend line. Flame cut edges should be machined or softened by heat treatment. Grind out nicks and round sharp corners. Minimum inside bending radius is 1 ½ times the thickness.
- F. Shop bolting and welds shall be tested and inspected as outlined in the Testing and Inspection paragraph of this specification section, as part of the Fabricator's internal Quality Control/Assurance program, if AISC Certified. The correction of faulty welds shall be in accordance with AWS "Structural Welding Code D1.1".
- G. Welding of all reinforcing steel shall comply with the provisions of AWS D1.4.
- H. Camber structural steel members where indicated on the drawings. Specified camber applies at fabrication facility. Contractor shall take necessary precautions to prevent or compensate for camber loss during shipment. For beams that are detailed without specified camber, the member shall be fabricated so that, after erection, any incidental camber due to rolling or shop fabrication is upward.

2.3 SHOP PRIMER

- A. Shop prime all structural steel with the following exceptions:
 1. Mask any contact surfaces with SP3 surface prep in connections using high strength slip critical bolts. Do not mask these surfaces if SP6 surface prep and Class B primer is to be provided.
 2. Mask any surfaces to be field welded.
 3. Do not prime the top surface of the top flange for all composite beams.
 4. Do not prime crane rails.
 5. Do not prime surfaces to receive spray-on fireproofing.
- B. Shop Primer for steel to be located in interior or architectural enclosed spaces:
 1. Refer to Section 09 91 24 – Interior Painting.
 2. Primer shall meet AISC requirements of Class B surface with a mean slip coefficient no less than 0.50, or all slip critical surfaces shall be masked.
- C. Shop Primer for steel to be exposed to exterior:
 1. Refer to Section 09 96 00 – High-Performance Coatings.
 2. Primer shall meet AISC requirements of Class B surface with a mean slip coefficient no less than 0.50.
- D. Shop primer on steel to receive intumescent coatings for fire rating shall be compatible with the intumescent finish.
- E. Surface Preparation:

1. Structural steel to remain in exterior unconditioned environment or to remain exposed to view, any steel to be galvanized: SSPC - SP6 Commercial Blast Cleaning.
2. Steel to remain within interior conditioned environment concealed from public view: SSPC - SP3 Power Tool Cleaning.

F. Application:

1. Structural steel shall receive one coat of shop primer except surfaces inaccessible after assembly shall receive a second coat.
2. Follow coating manufacturer's printed directions.
3. Minimum dry film thickness: 2.5 mils for interior conditioned environments
4. Minimum dry film thickness: 3.0 mils where exposed to view or to remain in exterior or unconditioned environments.

2.4 SHOP GALVANIZING

- A. Provide adequate vent or drain holes in closed shapes where necessary, subject to approval by the engineer.
- B. Surface Preparation: Combination of chemical degreasing bath, pickling bath, and flux bath with SSPC- SP6 as required.
- C. Shop hot-dip galvanize structural steel listed below in accordance with ASTM A123:
 1. All relieving angles supporting exterior walls.
 2. All lintels within exterior walls.
 3. All anchor rods, nuts, and washers subject to exterior exposure or unconditioned spaces.
 4. All embed plates subject to exterior exposure or unconditioned space.
 5. All embed plates for connections of building cladding.
 6. Any other steel indicated galvanized on the drawings.
- D. Do not provide final water bath or chromate bath for galvanized surfaces to receive additional coatings of paint.

2.5 FABRICATION OF AESS STEEL

- A. The fabricator shall handle the steel with care to avoid marking or distorting the steel members:
 1. Slings shall be nylon type or chains or wire rope with softeners.
 2. Care shall be taken to minimize damage to any shop paint or coating.
 3. When temporary braces or fixtures are required during fabrication or shipment, or to facilitate erection, care shall be taken to avoid blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.
 4. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.
 5. Tack welds not incorporated into final welds shall be treated consistently with requirements for final welds.

6. All backing and runoff tabs shall be removed and the welds ground smooth, where indicated in the drawings.
 7. All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.
- B. See Drawings for specific tolerance requirements.
- C. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from the theoretical curvature shall be equal to or less than the standard camber and sweep tolerances permitted for straight members in the applicable ASTM standard.
- D. The tolerance on overall profile dimensions of welded built-up members shall meet the requirements in AWS D1.1/D1.1M. For Categories AESS, 2, 3 and 4, the as-fabricated straightness tolerance for the member as a whole shall be one-half of that specified in AWS D1.1/D1.1M.
- E. For Categories AESS 3 and 4, copes, miters and cuts in surfaces exposed to view shall have a gap that is uniform within 1/16 in. (2mm), if shown to be an open joint. If instead the joint is shown to be in contact, the contact shall be uniform within 1/16 in. (2mm).
- F. AESS shall be prepared to meet the requirement of SSPC-SP 6. Prior to blast cleaning:
1. Grease or oil, if any is present, shall be removed by solvent cleaning to meet the requirements of SSC-SP 1.
 2. Weld spatter, slivers and similar surface discontinuities shall be removed.
 3. Sharp corners resulting from shearing, flame cutting or grinding shall be eased.
 4. Open holes and/or surface imperfections shall be filled with weld metal or metal reinforced body filler and smoothed by grinding or filing to the standards applicable to the shop fabrication of the materials.
- G. For Categories AESS 1 and 2, seams of hollow structural sections shall be acceptable as produced. For Category AESS 3, seams shall be oriented as specified in the contract documents. For Category AESS 4, seams shall be treated so they are not apparent.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect in accordance with AISC-360 and AISC-303 except where modified below.

Install members to proper alignment with finished building within allowable AISC-303 tolerances. See articles below for tolerances at special conditions. Make necessary adjustments to framing due to discrepancies in elevations and alignment before permanently fastening.

- B. The erector shall acquaint themselves with all conditions at the site, which can affect their methods and sequence of operations. Abide by Owner's regulations concerning traffic, parking and construction material delivery.

- C. Prior to the erection of any steel, the Contractor shall verify the location, elevation and plumbness of all anchor rods and concrete surfaces. Refer to the Field Survey paragraph of the Quality Assurance section of this section. The Contractor shall report immediately to the Engineer in writing any condition which they find unacceptable or that would prevent erection of the structural steel within AISC tolerance for plumbness and elevation. The Contractor shall be responsible for all corrections, and all corrections shall be made in a manner acceptable to the Engineer.
- D. Observe all federal, state and local laws and area trade rules in the erection and handling of structural steel. Erector is responsible for meeting OSHA rules. Notify Designer immediately if modifications to design are required to meet OSHA rules. Contractor is responsible for the cost of such modifications.
- E. See Sequencing paragraph of this specification section for temporary shoring and bracing requirements and definition of "entire project". Project is considered a "non-self-supporting" structure until completion of the entire project. Provide temporary shores, guys, bracing, and other supports to keep structural steel secure plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports and bracing only after structure is complete or sufficiently stable in its partially erected state.
- F. Field welding of perimeter bent plates for edge of slab and edge of deck at roof are considered "adjustable" connections in accordance with AISC-303. Edge of slab and roof deck are to be set to plus or minus 3/8" of the dimension from the theoretical column grid or theoretical center of beam, not the actual as erected center of beam.
- G. Make allowances for difference in temperature at time of erection and mean temperature at which structure will be completed and in service.
- H. Field connections shall be made using high strength bolts, bearing type, except where welded connections or where pre-tensioned and slip critical type bolts are indicated on the Structural Drawings.
 - 1. Where slip critical bolts are indicated on the Structural Drawings, the faying surfaces shall be left unpainted, unless a B primer and SP6 surface prep is used.
 - 2. Tension control bolts are not allowed in bearing type connections.
- I. Bolt Tightening:
 - 1. All Pretensioned and Slip Critical bolts shall be tensioned in accordance with Table 8.1 of the "Specification for Structural Joints Using High Strength Bolts".
 - 2. Slip critical and pretensioned bolts may be tightened by the turn of the nut or calibrated wrench method in accordance with the "Specification for Structural Joints Using ASTM High Strength Bolts", section 8.2.
- J. Field welds shall be accomplished by welders certified for the weld types and positions involved according to the "Structural Welding Code", A.W.S. D1.1. Use only shielded arc electrodes; E70xx, structural type.
 - 1. Low hydrogen electrodes shall be stored in strict accordance with the provisions of

AWS D1.1.

- K. Welding procedure for galvanized steel:
1. Remove galvanizing at least 1" to 10" from area to be welded.
 2. Protect units from damage by use of non-combustible shields as required.
 3. Weld in accordance with AWS D1.1.
 4. Remove weld slag.
 5. Touch-up area in accordance with ASTM A780 with zinc rich solder, zinc rich paint, or metallizing zinc spray.
- L. Post Installed Anchor Installation:
1. All anchors shall be installed in accordance with all the Manufacturer's Printed Installation Instructions and requirements including:
 - a. Diameter of hole and method of drilling hole
 - b. Condition of hole including moisture, dust and side roughness
 - 1) The anchor holes shall be free of water at the time of adhesive anchor installation.
 - 2) Temperature during installation
 - c. Use carbide tipped drilled to avoid damage to reinforcing during installation. Relocating anchors to avoid damage to the rebar shall be approved by the engineer.
- M. Any and all misfits shall be reported to the Engineer for resolution. Burning of new or unfair holes or cutting with a torch will not be permitted without the approval of the Engineer. Reamers, twist drills and saws shall be employed where burning is prohibited. Finish any field drilled or cut surfaces equal to a sheared surface and in accordance with AISC-360 Section M2.2. Surface roughness shall not exceed 1,000 micro-inches for holes or 2,000 micro-inches for copes and access holes as defined in ASME B46.1
- N. Any member that has assumed a bend or buckle in its final position due to forced fit shall have one or both ends and any intermediate connections unbolted and re-drilled or reamed to relieve such bowing to the satisfaction of the Engineer.
- O. No piece that has been bent, broken, twisted or otherwise damaged shall be incorporated into the work. Such pieces shall be repaired or corrected on the ground to the satisfaction of the Engineer or replaced with a new piece. Failure to observe this will be cause for rejection of the piece in place.
- P. Remove primer or any coating from the area to be welded prior to field welding.
- Q. Field touch up by Contractor: Field bolts, field welds and abrasions to the shop coat shall be repaired and painted by the Contractor using the same primer and care as for shop coat. All such surfaces shall be washed with a suitable degreasing solvent. This Contractor shall also remove any and all accumulations of mud, clay, rust, scale, grease, etc. that have been acquired, for any reason, during shipment, storage and erection and the shop coat restored to its original condition.

- R. Install headed studs using manufacturer-approved equipment in accordance with the manufacturer's instructions.

3.2 ERECTION FOR AESS DESIGNATED COMPONENTS

- A. The erector shall use special care in erecting AESS to avoid marking or distorting the AESS. The erector shall plan and execute all operations in such a manner that allows the architectural appearance of the structure to be maintained.
 - 1. Care shall be taken to minimize damage to any shop paint or coating.
 - 2. When temporary braces or fixtures are required to facilitate erection, care shall be taken to avoid any blemishes, holes or unsightly surfaces resulting from the use or removal of such temporary elements.
 - 3. Tack welds not incorporated into final welds shall be ground smooth where indicated.
 - 4. All backing and runoff tabs shall be removed and the welds ground smooth.
 - 5. All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.
 - 6. For Category AESS 4, open holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

3.3 ERECTION OF TRUSSES

- A. For members that are field assembled, element by element, in place, temporary support shall be used or an alternate erection plan shall be submitted. Tolerances shall be met in the supported condition with working points taken at points of temporary support.

3.4 BASEPLATE GROUTING

- A. Erector shall take care to ensure that load transmitted through anchor rods, shims, nuts and washers in temporary condition prior to grouting does not exceed their strength.
- B. Concrete surfaces and baseplates shall be clean and free from rust, grease, oil, and other debris.
- C. Place a watertight form around the area to be grouted. Formwork should be designed to ensure free flow of the grout under the baseplate and preventing the creation of air pockets. The height of the formwork should be sufficient to allow for complete gravity fill under the plate.
- D. Saturate the area to be grouted with water until uniformly damp. Remove excess water just before placing the grout.
- E. In order to avoid air pockets and ensure complete filling of the cavity between the baseplate and concrete, the grout shall be placed from one side only. Placement shall be completed without interruption.
- F. Dry packing or damp packing is not allowed.

- G. See manufacturer's printed instructions for additional information regarding preparation, mixing, placing and curing of the grout.

3.5 CLEANING UP

- A. Upon completion of erection, promptly remove all tools, equipment and rubbish caused by or resulting from the erection work.
- B. Coordinate the need for any temporary bracing to remain in place after the steel frame is complete but before the overall structural lateral system is complete with the Construction Manager and/or General Contractor.

3.6 TESTING AND INSPECTION – SHOP AND FIELD QUALITY ASSURANCE

- A. All testing and inspection shall be by the Owner's Testing and Inspection agency approved by the Architect-Engineer, performed by registered/qualified technicians. In AISC Certified Fabrication facilities, shop testing and inspection may be performed by the Contractor's Internal Quality Assurance personnel in lieu of the Owner's Independent Testing and Inspection Agency.
- B. Prior to testing bolts and welds in the field, all field assembled connections shall be visually inspected. The inspector shall become familiar with the Engineer-reviewed shop drawings prior to inspection. The inspector shall verify that bolts, field welds, field added plates and stiffeners agree with the Engineer-reviewed field connection detail on the shop drawings. This inspection shall include verifying weld lengths, faying bolt surfaces have been brought into contact, and connected member alignment is true. The inspector shall be given any Engineer-reviewed field changes made to the connections to include in the review.
- C. Test shop and field welds as indicated below (Shop welds may be tested by fabricators internal QA process, if AISC Certified):
 - 1. All complete penetration welds shall be tested for 100% of the total weld length using ultrasonic testing apparatus.
 - 2. All partial penetration welds shall be tested for 50% of the total weld length using the magnetic particle method.
 - 3. All welds shall be visually inspected in accordance with AWS D1.1 table 6.1.
- D. Inspect and test bolted connections.
 - 1. For connections where slip critical bolts are indicated on the Structural Drawings, testing and inspection methods shall conform to the "Specification for Structural Joints Using High Strength Bolts" for slip critical bolts. The testing shall include the inspector observing the "pre-installation testing" of each combination of grade, diameter, length and production lot of bolts and nuts to be used on the project. The "pre-installation testing" shall include bolt crews installing three sample bolts, of each combination, in a device that directly reads tension in the bolt. (e.g. Skidmore - Wilhelm Machine) Bolt crews shall demonstrate to the inspector the ability to install bolts to the tensions given in table 8.1 of "Specification for Structural Joints Using High Strength Bolts". The inspector shall observe bolt installation practices in the field to verify procedures used during the "pre-installation testing" are being properly applied.

- Any disputes that arise concerning the tension in the bolts shall be resolved with methods set forth in section 10 of "Specification for Structural Joints Using High Strength Bolts": Arbitration.
2. For all other connections, visual inspection to ensure that the plies of the connected elements have been brought into snug contact is required.
- E. Any field cut shapes and/or holes surfaces shall be inspected for compliance with Paragraph M2.2 of AISC 360 and AWS D1.1 commentary C4 1-72 sample 2.
- F. Verify number and spacing of headed anchor studs agree with the construction documents. Visually inspect all headed anchor stud welds and test those required by "Structural Welding Code", AWS D1.1, by bending the stud 15° from its original axis with no cracks or fracture in weld. Studs on the back of embedded plates to be cast in concrete shall be tested accordingly in the shop.
- G. Special Inspection of Post-Installed Anchor Installation shall be based on ICC-ES Evaluation Reports for each specific product:
1. Adhesive anchors installed in the horizontal or upwardly inclined vertical position shall be continuously observed/inspected during installation by the Owner's Testing and Inspection Agency. The inspector shall furnish a report to the engineer stating the work has been performed, the materials used, and the installation procedures used conform with the approved construction documents and the manufacturer's printed installation instructions.
- H. Testing Post-Installed Anchors:
1. The Testing Agency shall proof load test anchors in connections where specifically noted in the drawings.
 2. Pull-test each selected anchor to proof loads as noted on the drawings for the installation.
 3. Engineer and Anchor Manufacturer shall be notified immediately if an anchor does not pass test requirements. Contractor shall not proceed with corrective measures without written instructions from the Engineer describing remedial action to be taken.
- I. Inspect shop paint for conformance to specifications.
- J. Test reports shall be prepared by the testing agency giving the following:
1. The type and location of test conducted.
 2. The test results.
 3. Interpretation of the test results stating whether they comply with the Specification requirements.
 4. Procedure taken if the test results are not acceptable.
 5. Test results of re-tests after corrective measures have been completed. The cost of all re-testing shall be borne by the Contractor.

- K. Owner's Testing and Inspection program shall not be considered a substitute for Contractor's Internal Quality Assurance Program and does not relieve the Contractor of their responsibility to perform the work in accordance with the Contract Documents.

-END-

CLEAR CREEK WELCOME CENTER
DAPW PROJECT NO: 84003001-22-058-C1
FRP NO. 21071.00

STRUCTURAL STEEL

SECTION 051200

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SECTION 053100 - STEEL ROOF DECK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, equipment, and services necessary or incidental to complete the fabrication and erection of all steel roof deck work shown on the contract drawings and specified herein. Includes any supplemental support required that is not indicated on the contract drawings. Furnish and install any cold-formed perimeter bent plate where indicated at roof perimeter or openings.
 - 1. Install roof drain sump pans provided by others.

1.2 RELATED SECTIONS

- A. Structural Steel - Section 05 12 00
- B. Painting - Division 9
- C. Roof Drains - Division 22

1.3 REFERENCES

- A. Work on this project shall conform to all requirements of the latest version of the specifications listed below adopted by the applicable version of the building codes for this project except as modified by these contract documents. Re: Design Information drawing for applicable versions.

ASTM specifications apply in their entirety where specifically referenced in the body of this section.

Refer to specific portions of other guides, guidelines, and manuals where referenced in the body of this specification section

- 1. SDI RD 1.0 Standard for Steel Roof Deck
- 2. Steel Deck Institute Diaphragm Design Manual
- 3. AWS D1.3 Structural Welding Code – Sheet Steel.
- 4. Steel Deck Institute Manual of Construction
- 5. Steel Deck Institute Code of Standard Practice

1.4 INFORMATIONAL SUBMITTALS

- A. Product Data: Manufacturer's data sheets including capacities substantiating compliance with minimum requirements (UL, Factory Mutual) on each product to be used.

- B. Submit welders certificates verifying AWS qualification within previous 12 months to Owners Testing and Inspection Agency.

1.5 ACTION SUBMITTALS

- A. Consolidate submittal schedule with structural steel submittal schedule and submit for review by Engineer prior to shop drawing production.
- B. Prepare and submit completely dimensioned shop drawings for review.
- C. Shop drawings shall indicate the following:
 - 1. Deck type, gage, and finish.
 - 2. Connections of deck to framing members (type and locations).
 - 3. Connections of deck to adjacent deck pieces (type and locations).
 - 4. Shop and erection details.
 - 5. Markings, quantities, and locations of all deck sheets.
 - 6. Details of all deck accessories.
 - 7. Locations and dimensions of all shop cut openings.
 - 8. Details showing method of framing openings less than 12 inches square.
- D. Submit calculations for alternate fastening schemes other than the specified standard. Base calculations for strength (combined shear and uplift) and diaphragm stiffness on the SD1 Diaphragm Design Manual, 3rd Edition.
- E. Shop drawing action codes
 - 1. Shop drawings marked "Reviewed" do not require a resubmittal. Fabrication may commence.
 - 2. Shop drawings marked "Reviewed with exceptions" require the marked corrections to be made. No resubmittal is required. Fabrication may commence leading to steel erection once all exceptions noted are corrected.
 - 3. Shop drawings marked "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may not commence.
 - 4. Shop drawings marked both "Reviewed with Exceptions" and "Revise and Resubmit" require the marked corrections to be made. The drawings must be resubmitted for review. Fabrication may commence. Installation may not begin until the subsequent submission has been reviewed and returned for use in deck installation.
 - 5. Shop drawings marked "Rejected" must be resubmitted prior to any further review being completed.
- F. Fabrication shall not begin until shop drawings have been reviewed.

1.6 QUALITY ASSURANCE

- A. Welders: AWS D1.3 qualified and hold a current and valid certificate.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Protect steel deck and accessories to prevent damage during delivery, storage and handling in compliance with SDI Manual of Construction 2.
- B. Steel deck which is stored at the project site shall be stored off the ground with one end elevated to provide drainage, and shall be covered with a ventilated, waterproof cover.
- C. Steel deck which has become soiled shall be cleaned prior to installation.
- D. Take all precautions necessary to prevent corrosion or other damage to deck designated to remain architecturally exposed.

PART 2 - PRODUCTS

2.1 DECK

- A. Steel roof deck shall be fabricated from steel conforming to ASTM A653 Structural Steel with coating designation G60, or to ASTM A1008 Grades C, D or E (for painted deck). Provide $40 < f_y < 80$ for either type.
- B. Prior to forming, clean the sheet steel of all grease, oil and other foreign matter with a phosphatized type cleaner and provide one of the applicable protective coatings.
 - 1. For roof deck to receive sprayed-on fireproofing, provide galvanized deck.
 - 2. For all other roof decks, unless otherwise noted, apply a stabilized vinyl wash primer to phosphatize the surface then apply a shop coat of the manufacturer's standard baked-on rust inhibitor primer paint.
- C. Steel roof deck units shall be continuous over as many spans as the structural steel layout will permit. Provide the minimum number of continuous spans to meet superimposed load capacity requirements indicated on the drawings.
- D. Live load deflection under uniform total load capacity shall not exceed $L/240$.
- E. Provide depth and gage indicated on the drawings, wide rib steel roof deck, unless noted otherwise.

2.2 ACCESSORIES

- A. Provide closures, ridge and valley plates, and related accessories above and below the deck in 20 gage sheet steel with same finish as steel roof deck.
- B. Install sump pans for roof drains made of 14 gage, hot dipped galvanized steel, (sloped pan type) to be provided by others.
- C. Mechanical Fasteners for attaching to supporting steel: Hilti X-HSN 24 or approved equal to joists (base material thickness between 1/8" and 3/8") and Hilti X-ENP-L15 or approved equal to wide flange beams with flanges equal to or greater than 1/4" thick.
- D. Mechanical Fasteners for attaching to cold-formed steel framing: #10 or #12 Screw by Hilti or TEKS.
- E. Mechanical fasteners for fastening side laps shall be self-drilling, steel-to-steel screws. Fastener finish shall be zinc chromate plating of 0.3 mils minimum thickness.
 - 1. Standards: Hilti S-SLC 01 MHW
 - 2. Approved equal.
- F. 3/4" puddle welds may be substituted for mechanical fasteners to supporting steel when roof slope is less than 15 degrees if equivalent strength for combined shear and uplift as well as equivalent stiffness is provided.
- G. Galvanizing repair paint for galvanized deck: High zinc dust content paint for re-galvanizing welds in galvanized steel conforming to ASTM A 780.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erection of steel deck shall be accomplished in accordance with the manufacturer's standards and with the reviewed erection layout drawing.
- B. Install deck after structural support is in place, plumb, and true.
- C. End laps of sheets shall be a minimum of 2 inches and shall occur over supports.
- D. Erect steel deck units beginning at the low side working toward the high side to ensure that end laps are shingle fashion.
- E. Fasten steel roof deck to structural supports as indicated on the drawings.

1. Steel roof deck units shall be fastened to the steel framework at each support by fasteners indicated on the drawings, at the spacing indicated on the drawings, but at not more than 12" across the width of the roof units.
- F. Puddle welds (only on slopes less than 15 degrees) may be substituted for mechanical fastening systems if equivalent strength and stiffness to that specified are provided. Welds shall be in accordance with the requirements of AWS D1.3 and free of sharp points and edges.
- G. Install closures, sump pans where provided by others, ridge and valley plates, and other accessories required for complete installation in accordance with the manufacturer's specifications and erection drawings. Lap all adjoining pieces 3 inches minimum.
- H. Provide all required openings in the roof deck. Openings 12" square or larger shall be framed with structural steel per the "Typical Roof Opening Detail". All openings less than 12 inches wide shall be framed and/or reinforced per the deck manufacturer's recommendations as shown on the shop drawings.
- I. Field cutting parallel to flutes shall be done in the low flutes, taking care to leave sufficient horizontal material to permit satisfactory welding of deck to supporting steel. Provide Z shaped closure pieces for diaphragm shear transfer where deck cuts are required at an angle to the flutes.
- J. Repair damaged primed finish using same primer used by deck manufacturer; include welds and screws.
- K. Repair any damaged areas of galvanized coatings on both surfaces of deck with galvanized repair paint.
- L. Suspended MEP systems, light fixtures, ducts, or fire protection systems are not to be supported by the steel roof deck.

3.2 FIELD QUALITY CONTROL

- A. The Owner's Independent Testing and Inspection Agency shall inspect all attachments of the steel roof deck units to the structural steel framing for compliance with the contract documents and reviewed shop drawings. Daily inspection reports shall address all areas which have been inspected, and any deficiencies.

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STEEL ROOF DECK

SECTION 053100

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.02 PREINSTALLATION MEETINGS

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

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Roof-rafter framing.
6. Soffit framing.
7. Post-installed anchors.
8. Power-actuated anchors.
9. Sill sealer gasket.

B. Shop Drawings:

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

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

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or independently by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Miscellaneous structural clips and accessories.
- E. Research Reports:
 - 1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ClarkDietrich.
 2. Jaimes Industries.
 3. MBA Building Supplies.
 4. MRI Steel Framing, LLC.
 5. Marino\WARE.
 6. Mill Steel Framing; Mill Steel Company.
 7. State Building Products, Inc.
 8. Telling Industries.
 9. Mill Steel Framing.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads:
 2. Gravity Loads: As indicated on Drawings.
 3. Wind Loads: Delegated design engineer shall calculate specific component and cladding pressures per ASCE 7-10 using wind variables provided on drawings.
 4. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
 - b. Exterior Load-Bearing Wall Framing Supporting Glass Rainscreen Wall System: Deflection of 1/240 between connections to structural steel frame or a maximum of 3/8 inch, whichever is less.
 - c. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - d. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - e. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - f. Roof Rafter Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
 5. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

6. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Downward movement of 1/2 inch (13 mm).
 7. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and ASTM C955.

2.03 COLD-FORMED STEEL FRAMING MATERIALS

- A. Framing Members, General: Comply with ASTM C955 for conditions indicated.
- B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade:
 - a. Members 54 mil thick or greater; Minimum yield strength of 50 ksi.
 - b. Members 43 mil thick or less; Minimum yield strength of 33 ksi.
 2. Coating: G90 (Z275) or equivalent.
- C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, uncoated steel thickness of 68 mils minimum, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: G90 (Z275).

2.04 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 2. Minimum Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 2. Flange Width: 1-1/4 inches (32 mm).
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: Coordinate with wall width, minimum of 1-5/8 inches (41 mm).

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

2.05 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) .
 - 2. Minimum Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips, Exterior: 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 loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm) .
 - 2. Flange Width: 2 inch (50 mm) minimum.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - b. Flange Width: 2 inch (50 mm) minimum.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 - b. Flange Width: 3 inch (75 mm).

2.06 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Minimum Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) .
 2. Flange Width: 1-1/4 inches (32 mm).
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm) minimum.
 2. Flange Width: 3 inch (75 mm) minimum.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - b. Flange Width: 2 inch (50 mm) minimum.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm) .
 - b. Flange Width: 3 inch (75 mm).

2.07 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm) .
 2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.08 SOFFIT FRAMING

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

2.09 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.010 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554,, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Adhesive anchor.
 - a. Basis-of-Design: Hilti HIT-HY 200-R.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.011 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B, or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.012 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch (6 mm)** to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire

integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.04 INSTALLATION OF LOAD-BEARING WALL FRAMING

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: 24 inches (610 mm) maximum.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom tracks.
 - 2. Space studs as follows:
 - a. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches (1220 mm). Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
 1. Horizontal stud assemblies are required by building design and details as indicated in Drawings. Frame assemblies with tracks at each end of horizontal framing. Angle cuts on ends of studs as needed to fully seat stud in track.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect clips to building structure as needed to provide support to wall members.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.06 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect clips building structure as needed to provide support to wall members.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.07 INSTALLATION OF JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches (406 mm).
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.08 INSTALLATION TOLERANCES

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

3.09 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.010 FIELD QUALITY CONTROL

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

3.011 PROTECTION

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

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Metal ladders.
3. Metal floor plate.
4. Fabricated swing gate and hinge assemblies.
5. Metal bollards.
6. Metal downspout boots.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, and other steel items attached to the structural-steel framing.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Fabricated swing gate and hinge assemblies.
6. Metal bollards.

7. Metal downspout boots.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
 2. Metal ladders.
 3. Metal floor plate and supports.
 4. Fabricated swing gate and hinge assemblies.
 5. Metal bollards.
 6. Loose steel lintels.
 - C. Delegated Design Submittals: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.04 INFORMATIONAL SUBMITTALS
- A. Certificates:
 1. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
 2. Welding certificates.
 3. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
 - B. Research Reports: For post-installed anchors.
 - C. Delegated design engineer qualifications.
- 1.05 QUALITY ASSURANCE
- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- 1.06 FIELD CONDITIONS
- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Indiana, to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 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 A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- F. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- G. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 or Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ISO 3506-1); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1) or Group 2 (A4).

- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ASTM F836M).

2.04 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" dependent upon item's location.
- B. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.

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

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.

2.07 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
 - 1. Space siderails 16 inches (406 mm) apart unless otherwise indicated.
 - 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
 - 3. Rungs: 1-inch- (25-mm-) diameter or 1-inch- (25-mm-) square, steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin.
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Brown-Campbell Company; Abrasive coated solid ladder rung.
 - 2) IKG; MEBAC coated square ladder rungs.
 - 3) SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC; SlipNOT ladder rung.
6. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 7. Prime ladders, including brackets and fasteners, with primer specified in Section 099600 "High-Performance Coatings."

2.08 METAL FLOOR PLATE

- A. Fabricate from rolled-aluminum-alloy tread plate of thickness indicated below:
 1. Thickness: 1/4 inch (6.4 mm).
- B. Provide aluminum angle supports as indicated.
- C. Provide flush aluminum bar drop handles for lifting removable sections, one at each end of each section.

2.09 PREFABRICATED SWING GATES

- A. Provide swing gates fabricated with internal aluminum tube frame, mounting points, hinge system and proprietary styrene core. Gate assembly to be coated with 3/16 inch thick urethane coating and UV resistant top coating after assembly. Urethane and top coat to match color selected by Architect.
 1. Thickness: 4 inch thickness at perimeter of assembly..
- B. Hardware
 1. Hinge: Provide manufacturer's integral pipe supported hinge assembly and bearings.
 - a. Hinge Post: Provide 6 5/8 inch diameter, heavy duty schedule 40 galvanized steel Ppipe hinge post. Install post per Drawings and swing gate manufacturer's installation instructions.
 2. Pull: Provide manufacturer's standard aluminum pull finished to match door.
 3. Surface Bolts: Where indicated in Door Schedule and related Hardware Set, provide manufacturer's standard stainless steel surface mounted, spring retracting bolt to pavement. Drill hole to receive bolt in pavement.
 4. Keyed Drop Bolts: Where indicated in Door Schedule and related Hardware Set, provide keyed drop bolt specified in section 087100 – "Door Hardware". Mount drop bolt to gate panel with through stainless steel through bolts.
- C. Color: Color to be selected by Architect from manufacturer's full range of colors. Design intent is for gates to be similar in color to select grey limestone veneer.

- D. Products: Subject to compliance with requirements, provide the following manufacturer's product in sizes indicated in the Drawings.
 - 1. Mueller Door Company, Inc.; COR Series Gates and Access Doors. "Faux Corrugated" mounted vertical style.
 - a. (815) 385-8550

2.010 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe of diameter indicated in the Drawings.
- B. Fabricate surface mounted bollards with 3/8-inch- (9.5-mm-) thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.
- D. Hot-dip galvanize bollard assembly and sleeve.

2.011 Pipe Bollard Covers

- A. Fabricate from high density polyethylene with solid color throughout and ultraviolet light stabilizers.
 - 1. Provide domed top design.
- B. Size bollard to fit pipe size indicated in drawings.
 - 1. Allow attachment and removal of cover.
- C. Color: As selected by Architect from manufacturer's full range.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
 - 1. Omega Industrial Products: "HDPE Bollard Covers." 800-521-8272
 - 2. TAPCO; "Reflective Bollard Guard." 800-236-0112
 - 3. Sureguard Security Products; "Sureguard Shield." 800-756-3537

2.012 METAL DOWNSPOUT BOOTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Neenah Foundry Company; 4929-09C, or a comparable product by one of the following:
 - 1. J.R. Hoe & Sons Inc.

- B. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- C. 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. Provide units with integral cleanouts.
 - 1. Outlet: Vertical, offset, to discharge into pipe.
- D. Prime cast-iron downspout boots with primer specified in Section 099600 "High-Performance Coatings."

2.013 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. Fabricate in single lengths for each opening unless otherwise 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 one-twelfth of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.

2.014 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.015 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 099113 "Exterior Painting" or primers specified in Section 099123 "Interior Painting" per items location.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

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

3.02 INSTALLATION OF 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.

3.03 INSTALLATION OF METAL LADDERS

- A. Secure ladders to adjacent construction with the clip angles attached to the stringer.
- B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.04 INSTALLATION OF SURFACE MOUNTED METAL BOLLARDS

- A. Anchor bollards to existing construction with expansion anchors or adhesive set threaded rod. Provide four 3/4-inch (19-mm) anchors at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

- B. Fill bollards solidly with concrete, mounding top surface to shed water.
- C. Prime and paint bollards, or install bollard covers as indicated in Drawings.

3.05 INSTALLATION OF METAL BOLLARDS WITH CONCRETE FOUNDATION

- A. Anchor bollards in concrete foundation as indicated in Drawings. Provide pipe sleeves preset and anchored cast into concrete. Set and shim bollard plumb in sleeve. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
 - 1. After grout cures, fill bollards solidly with concrete. Strike concrete flush with top of steel pipe.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
- C. Prime and paint bollards, or install bollard covers as indicated in Drawings.

3.06 INSTALLATION OF PREFABRICATED SWING GATES

- A. Install prefabricated swing gates at locations indicated, mounted at heights indicated on Drawings above the paving surface.
 - 1. Install hinge post in same manner as specified and detailed for exterior bollards anchored in concrete foundations, filled with concrete struck flat with top of post.
 - a. Hinge post installation tolerance: Set post plumb plus or minus 1/8 inch (3.2 mm), measured from base to top of post. Set top of post at dimension indicated in manufacturer's instructions for height of gate.
 - 1) Hinge posts whose final cured condition is out of plumb beyond tolerance shall be removed and replaced prior to filling post with concrete.
 - 2. Paint hinge post to match gate as specified in section 099600 – "High-Performance Coatings".

3.07 INSTALLATION OF METAL DOWNSPOUT BOOTS

- A. Anchor metal downspout boots to concrete or masonry construction to comply with manufacturer's written instructions.
- B. Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.
- C. Paint downspout boots as specified in Section 099113 "Exterior Painting".

3.08 REPAIRS

- A. Touchup Painting:

1. Touchup primer at field welds, bolted connections, and abraded areas of shop paint as specified in Section 099113 "Exterior Painting." or Section 099123 "Interior Painting" per items location.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Steel railings.

1.02 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. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Post-installed anchors.
 - 3. Shop primer.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated design professional engineer.
- B. Welding certificates.
- C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer licensed in the State of Indiana, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 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.

2.03 STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.04 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
 - 2. Finish exposed fasteners to match appearance, including color and texture, of railings.
- 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 and capable of withstanding design loads.
- C. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material: Alloy Group 1 (A1) or Group 2 (A4) stainless steel bolts, ASTM F593, and nuts, ASTM F594. Provide size necessary to meet diameter and embedment requirements to resist loads imposed on connections.

2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

2.06 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. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 2. 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 are exposed to weather in a manner that excludes water.
1. Provide weep holes where water may accumulate.
 2. Locate weep holes in inconspicuous locations.
- 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. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.
1. Provide slide bolt latch to hold gates open when guard rails are removed.
 - a. Basis-of-Design: Ives 481 Chain Door Guard.
- I. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.
- J. Form changes in direction as follows:
1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- 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 hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.

- O. For removable railing posts, fabricate slip-fit sockets from steel pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
 - 2. Basis of Design: Garlock Safety Systems Single and Double Post Floor Mounts.

2.07 STEEL AND IRON FINISHES

- A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
 - 1. Railings Indicated to Receive Primers Specified in Section 099124 "Interior Painting": SSPC-SP 6/NACE No. 3.
- C. Primer Application: Apply primer to prepared surfaces of railings unless otherwise indicated..
 - 1. Shop prime uncoated railings with primers specified in Section 099123 "Interior Painting"

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners necessary for securing railings and for properly transferring loads to in-place construction.

3.02 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.

3.03 ANCHORING POSTS

- A. Install removable railing sections, where indicated, in slip-fit base sockets anchored to cast-in-place concrete.
- B. Install railing gates level, plumb, and secure for full opening without interference.
 - 1. Attach hinge hardware to masonry with post-anchor fasteners through base plate welded to hinge.
 - 2. Adjust hardware for smooth operation.

3.04 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with primer used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.05 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.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 055213

SECTION 055819 – DUCT ENCLOSURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes floor mounted duct enclosures that receive linear bar diffusers.

1.03 RELATED SECTIONS

- A. Section 233713 “Diffusers, Registers, and Grilles” for linear bar diffusers and frames.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for heating-cooling unit enclosures.
- C. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.

1.06 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct enclosures. Show dimensions of ductwork and holes in concrete slab, housing penetrations, attachments, and necessary clearances.
- B. Qualification Data: For fabricator, and installer.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing enclosures 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. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups of typical duct enclosures as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver duct enclosures wrapped in protective coverings or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

1.09 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with duct enclosures by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design heating-cooling unit enclosures.
- B. Structural Performance: Duct unit enclosures shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
 1. Live Loads: 100 lbf/sq. ft. (4.8 kN/sq. m) or a concentrated load of 300 lbf (1.3 kN) on an area of 4 sq. in. (26 sq. cm), whichever produces the greater stress.

2.02 HEATING-COOLING UNIT ENCLOSURES

- A. Approved Fabricators: Subject to compliance with requirements, provide products fabricated by the following:
 1. Bo-mar Industries.
 2. Tarpenning-LaFollette Company, Inc.
- B. Fabricate enclosures from metal of type and thickness indicated below:
 1. Galvanized-Steel Sheet:
 - a. Front and Back Panels: Minimum 0.064 inch (1.63 mm).
 - b. Concealed Brace Panels: Minimum 0.0516 inch (1.31 mm).
 - c. Finish: Baked enamel.
- C. Weld seams and connections unless otherwise indicated or unless other methods are necessary for assembly in field.
- D. Incorporate stiffeners needed for strength and rigidity.

- E. Coordinate construction, configuration, and dimensions of enclosures with those of concrete floor and ductwork. Provide blind knockouts and supports for ductwork where indicated or needed.

2.03 SHEET METAL

- A. Fabricate units from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Galvanized-Steel Sheet: ASTM A653/A653M, G90 (Z275) coating, either commercial steel or forming steel.

2.04 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints between enclosure units; as recommended in writing by fabricator.
- B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
- C. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting formed metal items and for attaching them to other work.
 - 2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble duct enclosures in 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.
- B. Coordinate dimensions and attachment methods of duct enclosures with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

- E. Build in brackets as needed to support and anchor duct enclosures to adjoining construction.
- F. Provide support framing, mounting, and attachment clips; splice sleeves; fasteners; and accessories needed to install duct enclosures.
- G. Where welded joints are called for in approved shop drawings, weld joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.06 GALVANIZED-STEEL SHEET FINISHES

- A. Preparing Galvanized Items for Factory Finishing: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - 1. Color and Gloss: Black, MPI Gloss Level 4.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of duct enclosures.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Locate and place duct enclosures level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install duct enclosures.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers and sealants as the Work progresses.

- E. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.03 ADJUSTING AND CLEANING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.04 PROTECTION

- A. Protect finishes of duct enclosures from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 055819

SECTION 057500 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Custom aluminum filler panels.
2. Custom aluminum corner guards
3. Dichroic glass façade metal base.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for items made of formed metal for flashings and trim.
2. Section 077100 "Roof Specialties" for items made of formed metal for parapets and copings.

1.02 COORDINATION

- A. Coordinate installation of anchorages for decorative formed metal items. 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 items to Project site in time for installation.
- B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative formed metal.
1. Include plans, elevations, component details, and attachment details.
 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: For Installer and fabricator.
- C. Mill Certificates: Signed by stainless steel manufacturers certifying that products furnished comply with requirements.
- D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative formed metal 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. Installer Qualifications: Fabricator of products.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

- A. For decorative metal items, obtain each color, grade, finish, type, and variety of metal from single source with resources to provide products of consistent quality in appearance and physical properties.
 - 1. Approved Fabricators.

- a. Bo-mar Industries.
- b. Tarpenning-LaFollette Company, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.03 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Aluminum Sheet: Flat sheet complying with ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of Alloy 6061.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316, stretcher-leveled standard of flatness.

2.04 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in decorative formed metal and remain weathertight; as recommended in writing by decorative formed metal manufacturer.
 1. ASTM D1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
 2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: Elastomeric sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- C. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- D. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless exposed fasteners are submitted, noted as required and approved in final shop drawings.
 2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- E. Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

- F. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
- G. Anchor Materials:
 - 1. Material for Exterior Locations, Where Stainless Steel is Indicated and Where Aluminum is Indicated: Alloy Group 1 (A1) Group 2 (A4) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.05 PAINTS AND COATINGS

- A. Shop Primers: Comply with Section 099123 "Interior Painting" for primer for painted aluminum fabrications.

2.06 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in 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.
- B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.07 FILLER PANELS AND CORNER GUARD TRIM

- A. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - 1. Aluminum Sheet: 0.080 inch (2.032 mm).
- B. Predrill holes for concealed fasteners. Size fasteners to support units, with fasteners spaced to prevent buckling or waviness in finished surfaces.

2.08 DICHROIC GLASS FAÇADE METAL BASE

- A. Form metal base from metal of type and thickness indicated below:
 - 1. Stainless Steel Sheet: 0.050 inch (1.27 mm).
 - a. Finish: No. 4.
- B. Joints: Form joints between sections of base with concealed stainless steel spline of same thickness as metal base. Spline profile to align with and be tight to back of back of base. Form spline the full profile of the base. Weld spline to one side of joint. Set joint width between metal base sections at 1/4 inch and provide non-curing urethane tape sealant to back of metal base section to seal between spline and base.

2.09 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are 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.

2.010 ALUMINUM FINISHES

- A. Shop prime aluminum corner guards and filler panels as specified in section 099124 "Interior Painting".
- B. Finish aluminum corner guards and filler panels after installation and finishing of adjacent gypsum board. Repair primer and apply finish coats.

2.011 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks, weld marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- E. Corrosion Protection: Provide plastic shims as permanent separation of aluminum and CMU masonry surfaces where metals would otherwise be in direct contact with each other and could result in corrosion or deterioration of aluminum.

3.03 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.

- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.04 PROTECTION

- A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057500

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Miscellaneous lumber.
5. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.02 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.03 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. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. 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.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS

- ##### A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 19 percent.
2. Dimension Lumber: 19 percent unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- ##### A. Preservative Treatment by Pressure Process: AWWA U1, Use categories as follows:

1. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting but

with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact-type hazards. Include the following items:

- a. Wood nailers, blocking, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood framing members that are less than 18 inches (460 mm) above the ground.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- 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.

2.03 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply 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 in accordance with 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 (3.2 m) beyond the centerline of the burners at any time during the test.
1. Treatment is not to promote corrosion of metal fasteners.
 2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 3. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels.

2.04 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. Roofing Nailers: Preservative treated, structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

2.05 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.06 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide screws of Type 304 stainless steel.

B. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.07 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum

foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. 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.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Sort and select lumber so that natural characteristics do 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.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use copper naphthenate.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- I. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
 - 1. Fasten nailers wider than nominal 2 inches in two rows to resist twist, cup, and bow in wood after installation.
- J. Use steel screws to fasten untreated and fire retardant treated wood blocking and backing panels.
- K. Use stainless steel screws to fasten preservative treated wood blocking.

- L. 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.

3.02 INSTALLATION OF WOOD BLOCKING AND NAILERS

- 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 wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.01. SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Composite nail base insulated wall sheathing.
5. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072726 "Fluid-Applied Air Barriers" for water-resistive barrier applied over wall sheathing.

1.02. PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.03. 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. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing 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.

1.04. INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.
- D. Field quality-control reports.

1.05. QUALITY ASSURANCE

- A. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, curtain wall frames, steel frames and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups 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.

1.06. 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

2.01. WOOD PANEL PRODUCTS

- A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.02. PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.03. FIRE-RETARDANT-TREATED PLYWOOD

- 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 Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with 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 (3.2 m) 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 are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
- C. 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.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Composite nail base insulated wall sheathing.

2.04. WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exterior, Structural I B/C sheathing.

1. Nominal Thickness: 23/32 inch (18.26 mm) and 19/32 inch (15.08 mm) as indicated in Drawings..

B. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Gypsum LLC.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - c. USG Corporation.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) or 48 by 108 inches (1219 by 2743 mm) or 48 by 120 inches (1219 by 3048 mm) as needed to provide the most efficient installation of sheathing over the custom vertical stud framing.

2.05. ROOF SHEATHING

A. Plywood Sheathing: DOC PS 1, Preservative-Treated, Exterior, Structural I B/C sheathing.

1. Nominal Thickness: Not less than 23/32 inch (11.9 mm).

2.06. PARAPET SHEATHING

A. Glass-Mat Gypsum Sheathing, Parapets: ASTM C1177/C1177M.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum LLC.; DensDeck Prime Roof Board.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell FA™ Glass Mat Roof Board.
 - c. USG Corporation; Securock UltraLight Coated Glass-Mat Roof Board.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick, factory primed, roof substrate board.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

2.07. COMPOSITE NAIL BASE INSULATED ROOF WALL SHEATHING

A. Fire-Treated Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 oriented strand board on one face.

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. Hunter Panels; Xci Ply.
2. Polyisocyanurate-Foam Thickness: 1-1/2 inches (38 mm).
3. Plywood Nominal Thickness: 5/8 inch (15.9 mm).

4. Fasteners: Provide fasteners approved by composite sheathing fabricator, consistent with fastener type and spacing for application to light gauge metal framing.

2.08. FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Composite Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length and pattern approved by sheathing manufacturer for thickness of sheathing to be attached.
- E. 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.
 1. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C954.

2.09. SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Joints and Sealants at Glass-Mat Gypsum Sheathing to Receive Fluid-Applied Membrane Air Barrier: Provide joint treatments specified in section 072726 – “Fluid-Applied Membrane Air Barriers”.
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, 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 (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), 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

3.01. 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. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Composite sheathing fabricator's fastening schedule for vertical application to cold formed metal framing.
- D. Coordinate wall, parapet and roof 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. 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.

3.02. INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch (3 mm) apart at edges and ends.

3.03. INSTALLATION OF GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch (6.4-mm) 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 panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
 2. Fasten composite sheathing with fastener type and spacing approved by fabricator.
- E. At sheathing joints that are not part coated with a fluid-applied membrane air barrier, 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 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 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior trim.
2. Paneling.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 099300 "Staining and Transparent Finishing" for finishing and backpriming of interior finish carpentry.

1.02 ACTION SUBMITTALS

A. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. (300 sq. cm) for lumber.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.04 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

2.02 INTERIOR TRIM

- A. Softwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings. Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
 - 1. Species: Southern pine.
 - 2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - 3. Finger Jointing: Not allowed.
 - 4. Matching: Selected for compatible grain and color.
 - 5. Pattern: WM 103, 1 1/16-by-1 1/16-inch (27-by-27-mm) quarter-round.

2.03 PANELING

- A. Board Paneling:
 - 1. Species and Grade:
 - a. Southern pine; SPIB C & Btr Paneling.
 - 2. Maximum Moisture Content: 19 percent.
 - 3. Pattern:
 - a. V-joint, tongue and groove, WWPA WP 4.
 - 4. Net Coverage Width: Not less than 5-1/16 inches (128 mm).
 - 5. Suppliers: Product is available from the following suppliers.
 - a. Bear Creek Lumber; Winthrop, Washington.
 - b. Follen Wood; Star, Mississippi.

- c. McShawn Wood Products; McShan, Alabama
- d. Southern Wood Specialties; Flomation, Alabama.
- e. Volterra Architectural Products; Phoenix, Arizona.

2.04 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

2.05 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 - 1. Interior standing and running trim, except shoe and crown molds.
 - 2. Wood-board paneling.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Back-prime wood trim and panel boards with primer specified in section 099300 – “Staining and Transparent Finishing”.
- B. Clean substrates of projections and substances detrimental to application.
- C. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.04 INSTALLATION OF INTERIOR TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
1. Do not use pieces less than 24 inches (610 mm) long, except where required by wall layout or room configuration.
 2. Stagger joints in adjacent and related standing and running trim.
 3. Cope or miter at quarter round trim returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 4. Use scarf joints for end-to-end joints.
 5. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 6. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 7. Fasten to prevent movement or warping.
 8. Countersink fastener heads on exposed carpentry work and fill holes.

3.05 INSTALLATION OF PANELING

- A. Board Paneling: Install according to manufacturer's written instructions.
1. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
 2. Stagger end joints in random pattern to uniformly distribute joints on each wall.
 3. Install with uniform end joints. Locate end joints only over furring or blocking.
 4. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards.
 5. Install with uniform tight joints between boards.
 6. Fasten paneling by blind nailing through tongues.

3.06 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.07 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.08 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 066100 - SIMULATED STONE FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Solid-surface-material window and curtain wall sills.
 - 2. Solid-surface-material panels at hand dryers.

1.03 ACTION SUBMITTALS

- A. Product Data: For simulated stone materials.
- B. Shop Drawings: For simulated stone fabrications. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
 - 1. Solid-surface-material, 6 inches (150 mm) square.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of fabrications by field measurements. Confirm countertop dimensions after base cabinets are installed, but before countertop fabrication is complete.

1.05 COORDINATION

- A. Coordinate locations of utilities that will penetrate fabrications.

PART 2 - PRODUCTS

2.01 SOLID-SURFACE-MATERIAL FABRICATIONS

- A. Panels at Hand Dryers:

1. Configuration: Provide panels of size and thickness indicated in Drawings.
2. Material: 1/4-inch (6.3-mm) thick, solid surface.
3. Substrate at Welcome Center: 1/2-inch (12.7-mm) thick cementitious backer units.
4. Substrate at Trucker Restrooms: Painted (White) CMU masonry.

B. Window Sills:

1. Configuration: Provide window sills with configuration indicated in Drawings.
2. Material: 1/2-inch (12.7-mm) thick, solid surface.
3. Substrate: 3/4-inch (19-mm) thick marine core plywood.

C. Fabrication: Fabricate units in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.02 SOLID SURFACE MATERIAL

A. Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

1. Manufacturer: Subject to compliance with requirements, provide product listed in the Finish Legend in the Drawings, or an approved equal product by one of the following:
 - a. E. I. du Pont de Nemours and Company.
 - b. Formica Corporation.
 - c. LX Hausys, Hi Macs.
 - d. Samsung Chemical USA, Inc.
 - e. Wilsonart International.
2. Type: Provide Standard Type unless Special Purpose Type is indicated.
3. Colors and Patterns: As indicated by manufacturer's designations in Finish Legend in Drawings.

2.03 ACCESSORY MATERIALS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 1/2 inch (12.7 mm).

B. Marine Core Plywood: Marine core softwood plywood complying with DOC PS 1, Grade AB Marine, touch sanded.

1. Manufacturers.
 - a. Roseburg.
 - b. Weyerhaeuser

C. Adhesives: Adhere solid surface material to substrates with clear silicone adhesive approved by manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fabrications level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 M).
- B. Adhere window sills to plywood substrate anchored to blocking and framing. Prepare face of plywood and use adhesive such that surfaces and adhesive do not show through sills upon completion of installation.
- C. Welcome Center Hand Dryers: Adhere panels at hand dryers to substrate (cementitious backer board) fastened and adhered to concrete masonry. Paint cementitious backer board white using system specified in section 099124 – “Interior Painting”. Use adhesive such that surfaces and adhesive do not show through panels upon completion of installation.
- D. Trucker Restroom Hand Dryers: Adhere panels at hand dryers to substrate (painted CMU). Use adhesive such that surfaces and adhesive do not show through panels upon completion of installation.

3.01 ADJUSTING AND CLEANING

- A. Repair damages fabrications to eliminate functional and visual defects. Where repair is not possible, replace damaged fabrications.
- B. Clean fabrications and protect them from damage from adjacent construction activities.

END OF SECTION 066100

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, emulsified-asphalt dampproofing applied to cavity face of concrete and concrete masonry of exterior walls.

1.03 ACTION SUBMITTALS

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

1.04 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.02 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.03 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ChemMasters, Inc.
 - 2. Euclid Chemical Company (The); an RPM company.
 - 3. Henry Company.
 - 4. Karnak Corporation.
 - 5. Master Builders Solutions.
 - 6. W.R. Meadows, Inc.
- B. Trowel Coats: ASTM D1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.04 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- D. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill the holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.03 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.05 PROTECTION

- A. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 071113

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Modified bituminous sheet waterproofing.
 - 2. Blindsight sheet waterproofing.
 - 3. Insulation drainage panels.

1.03 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.

1.04 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, expansion joints, 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 (200-by-200-mm) square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch (100-by-100-mm) square of drainage panel.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Research Reports: For modified bituminous sheet waterproofing/termite barrier, showing compliance with ICC AC380.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: 100 sq. ft. (9.3 sq. m) in area.
 - b. Description: Each type of installation.
 - 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.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Henry Company; a Carlisle company; Blueskin WP 200.
 - b. Polyguard Products, Inc.; Polyguard 650 Membrane.
 - c. Soprema, Inc.; COLPHENE 3000.
 - d. W. R. Meadows, Inc; Mel-Rol.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 300 psi (2.1 MPa) minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C836/C836M.
 - e. Puncture Resistance: 50 lbf (222 N) minimum; ASTM E154/E154M.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
 - g. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet (60 m) minimum; ASTM D5385.
 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.03 BLINDSIDE SHEET WATERPROOFING

- A. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the following physical properties:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Henry Company; a Carlisle company; Blueskin PreSeal 435.
 - b. Polyguard Products, Inc Polyguard Underseal Underslab Membrane.
 - c. Soprema, Inc.; COLPHENE BSW-H.
 - d. W. R. Meadows, Inc PRECON.
 2. Physical Properties:
 - a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.

- b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D903, modified.
 - c. Lap Adhesion: 5 lbf/in. (875 N/m) minimum; ASTM D1876, modified.
 - d. Hydrostatic-Head Resistance: 230 feet (70 m); ASTM D5385, modified.
 - e. Puncture Resistance: 200 lbf (890 N) minimum; ASTM E154/E154M.
 - f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.
- B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.04 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- 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 (25 by 3 mm), predrilled at 9-inch (229-mm) centers.
- G. Protection Course, Extruded-Polystyrene Board Insulation, Unfaced: ASTM C578, Type X, 1/2 inch (13 mm) thick.

2.05 INSULATION DRAINAGE PANELS

- A. Geotextile-Faced, Wall-Insulation Type IV, Drainage Panels: Extruded-polystyrene board insulation according to ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Owens Corning.
 - b. T. Clear Corporation, a subsidiary of Fin Pan Inc.
 - 2. Thickness: 2 inches (50 mm)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of 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 D4263.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.
- E. Fill form tie holes, honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).
- G. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.03 INSTALLATION OF TUNNEL UNDERSLAB/FOUNDATION HORIZONTAL BLINDSIDE SHEET WATERPROOFING

- A. Install blindside sheet waterproofing according to manufacturer's written instructions.
- B. Install sheet with face against substrate and with face to bond with concrete up. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.
- C. Turn sheet up at edges of slab/foundation minimum of 18 inches to permit tie in of underslab waterproofing to vertical waterproofing.
- D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- F. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.04 INSTALLATION OF MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.
- 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- (64-mm-) 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 (minus 4 and plus 5 deg C), 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 (16 deg C).
- 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 underslab/foundation 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 (150 mm) beyond repaired areas in all directions.
- H. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.05 INSTALLATION OF INSULATION DRAINAGE PANELS

- A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.

3.06 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels 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.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Glass-fiber board insulation.
4. Mineral-wool blanket insulation.
5. Mineral-wool board insulation.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for insulation installed in masonry cavity walls.
2. Section 061600 "Sheathing" for composite foam-plastic board/plywood sheathing installed directly over steel framing.
3. Section 071326 "Self-Adhering Sheet Waterproofing" for insulated drainage panels installed with waterproofing system.
4. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
5. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction.
6. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Glass-fiber board insulation.
4. Mineral-wool blanket insulation.
5. Mineral-wool board insulation.

1.04 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DuPont de Nemours, Inc.
 - b. Kingspan Insulation LLC.
 - c. Owens Corning.
 - d. The Dow Chemical Company.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 - 6. Provide pre-scored boards, score to snap into sections that fit between z-girt framing members.

2.02 GLASS-FIBER BLANKET INSULATION (Option to Mineral Wool Blanket Insulation)

- A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. CertainTeed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- B. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.03 GLASS-FIBER BOARD INSULATION (Option to Mineral Wool Board Insulation)

- A. Glass-Fiber Board Insulation, Unfaced: ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Nominal Density: 4.25 lb/cu. ft. (68 kg/cu. m).
 5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 6. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.04 MINERAL-WOOL BLANKET INSULATION (Option to Glass-Fiber Blanket Insulation)

- A. Mineral-Wool Blanket Insulation, Unfaced : ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Owens Corning.
 - c. ROCKWOOL.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- B. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- 2.05 MINERAL-WOOL BOARD INSULATION (Option to Glass-Fiber Board Insulation)
- A. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Owens Corning.
 - c. ROCKWOOL.
 2. Nominal Density: 4 lb/cu. ft. (64 kg/cu. m).
 3. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
 4. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- 2.06 INSULATION FASTENERS
- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AGM Industries, Inc.
 - b. Gemco.
2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.07 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

- 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.03 INSTALLATION OF SLAB INSULATION

- A. On vertical foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

3.04 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.05 INSTALLATION OF WALL INSULATION BEHIND METAL PANELS

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between cold formed metal z furring channels, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.

3.06 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.

a. Exterior Walls: Set units with facing placed toward interior of construction.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.07 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. 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 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.
2. Accessories.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by qualified testing agency.
2. Research Reports: For spray-applied polyurethane foam-plastic insulation, from an agency acceptable to authorities having jurisdiction or ICC-ES showing compliance with specified surface-burning characteristics and NFPA 276.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

C. Qualification Statements: For Installer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.01 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2 lb/cu. ft. (32 kg/cu. m) and minimum aged R-value at 1-inch (25.4-mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (43 K x sq. m/W at 24 deg C).

1. Manufacturers: Subject to compliance with requirements, provide one of the following products:
 - a. Carlisle Spray Foam Insulation; SealTite PRO HFO.
 - b. Huntsman Building Solutions; Heatlock HFO Pro.
 - c. Johns Manville; a Berkshire Hathaway company; JM Corbond IV.
2. Surface-Burning 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: 450 or less.

2.02 ACCESSORIES

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates as recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.02 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions and to voids as indicated in Drawings.
 1. Do not cover insulation prior to any required spray foam insulation inspections.

3.03 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

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

B. Related Requirements:

- 1. Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing on wall assemblies.

1.03 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.

- B. EIFS: Exterior insulation and finish system(s).

- C. IBC: International Building Code.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

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

- B. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

- 1. Include similar Samples of exposed accessories involving color selection.

- C. Samples for Verification: 24-inch- (600-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including each trim profile,.

- 1. Include exposed trim and accessory samples to verify color selected.
- 2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
 - 1. EIFS complies with requirements.
 - 2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
 - 3. Accessory products installed with EIFS, including joint sealants, flashing, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- C. Product Certificates: From manufacturers for the following.
 - 1. Cementitious materials and aggregates
 - 2. Insulation
 - 3. Joint sealants.
- D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.07 CLOSEOUT SUBMITTALS

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

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by specified manufacturer as qualified to install system.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area 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.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - 1. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.010 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.
 - 1. Proceed with installation of coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.011 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
 - 2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. EIFS drainage components.
 - 3. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sto Corp.; StoQuik® Silver DrainScreen™ with Stolit Lotusan 1.0 fine finish or a comparable product by one of the following:
 - 1. Master Builders Senergy; Cement Board Stucco 1000 System.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.02 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:
1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
 2. Structural Performance of Assembly and Components:
 - a. Wind Loads: Specific component design wind pressures shall be calculated by supplier's engineer based on Design Loads for Structural Frame and Design Wind Load Criteria for Cladding and Cladding Backup, as provided in Drawings.
 3. Impact Performance: ASTM E2568, Standard impact resistance.
 4. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested according to ASTM D968, Method A.
 5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D3273 and evaluated according to ASTM D3274.
 6. Drainage Efficiency: 90 percent average minimum when tested according to ASTM E2273.

2.03 EIFS MATERIALS

- A. Water-Resistive Barrier Coating: As specified in section 072726 Fluid-Applied Membrane Air Barriers.
- B. Drainage Mat: Three-dimensional, nonwoven, entangled filament, nylon or plastic mat designed to drain incidental moisture by gravity; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer,
1. Thickness: 10 mm
 2. Fasteners: Manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
- C. Cementitious Backer Units, Walls: ASTM C1325, Type A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Gypsum Company; Permabase Cement Board.
 2. Thickness: 1/2 inch (12.7 mm).
 3. Fasteners: Stainless steel self-drilling bugle head screws of length necessary to penetrate cold-formed metal framing 3/8 inch (10 mm)
 4. Joint Tape Material: Minimum 4 inch (102 mm) wide alkali-resistant fiberglass mesh tape to be embedded in finish system base coat.
- D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098/E2098M and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
 3. Detail-Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
 4. Corner-Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).
- E. Water-Resistant Base Coat: EIFS manufacturer's standard water-resistant formulation complying with the following:
1. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
- F. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- G. Finish Coat: EIFS manufacturer's water repelling acrylic-based coating with enhanced mildew resistance.
1. Products.
 - a. Master Builders Senergy; Senerflex Finish.
 - b. Sto Corp; Stolit Lotusan.
 2. Colors: Match Architect's sample, equal to Master Builders Synergy "Ultra White" or Sto Corp #16002 .
 3. Textures: Match Architect's sample, fine finish.
- H. Water: Potable.
- I. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.
1. Casing Bead: Prefabricated, one-piece type for attachment to substrate and form edge to system, of depth required to suit thickness of drainage mat, cement board and coating, with face leg perforated for bonding to coating and back leg.
 - a. Plastic Components; CB EIFS Casing Bead, CB-1-16.
 2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of drainage mat, cement board, and coating, with face leg perforated for bonding to coating and 2 inch tall back leg to flash into fluid-applied membrane air barrier.
 - a. Plastic Components; i Drip Track, iDT-1.
 3. Corner Bead: Plastic Components; EIFS Corner Bead, 4.
 4. Expansion/Control Joint: Plastic Components; EIFS "M" Contol Joint, 2138XS.

2.04 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine conditions at system edges and field for completion of air barrier, seals between barrier and glass screen wall brackets, completion of roof flashings, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory and/or incomplete conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.03 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.04 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of drainage mat and cement board substrates.

3.05 DRAINAGE MAT INSTALLATION

- A. Drainage Mat: Apply wrinkle free, continuously, with edges butted and mechanically secured with fasteners over water-resistive barrier coating.

3.06 CEMENTIOUS BACKER UNIT INSTALLATION

- A. General: Mechanically attach cementitious backer units through substrate in compliance with written requirements for finish system and the following:
 1. Install top surface of fastener heads flush with plane of cementitious backer units. Install fasteners into or through substrates with the following minimum penetration of framing:
 - a. Steel Framing: 3/8 inch (10 mm).
 2. Apply cementitious backer units over substrates in courses with long edges of boards oriented vertically and located on framing member.
 3. Begin first course of cementitious backer unit from level drip screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 4. Stagger vertical joints of cementitious backer units in successive courses to produce running bond pattern. Locate joints, so no piece is less than 16 inches (400 mm) wide or 24 inches (600 mm) high..
 - a. Mechanical Attachment: Offset joints of cementitious backer units from horizontal joints in sheathing.
 5. Abut cementitious backer units tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards.
 6. Cut cementitious backer units to fit corners and projecting brackets precisely and to produce edges and shapes complying with details indicated.
 7. Treat exposed edges of cementitious backer units as follows:
 - a. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - b. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 8. Coordinate installation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.

3.07 BASE-COAT APPLICATION

- A. Control Joints: Position and fix vinyl control joint trim onto cementitious backer units by embedding trim in thin bed of base coat at locations indicated in Drawings. Maintain plumb, true lines in alignment of trim. Maintain continuous line at butted end joints. Trowel off excess base coat and allow base coat to cure prior to proceeding.
- B. Water-Resistant Base Coat: Apply full-thickness coverage over cementitious backer units to flanges of trim and to other surfaces indicated on Drawings.
- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise

treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

- D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings for metal brackets for glass rain screen assembly, extending 4 inches (100 mm) beyond perimeter.
 - 1. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.08 FINISH-COAT APPLICATION

- A. Primer: Apply over dry base coat where required by manufacturer's written instructions.
- B. Finish Coat: Apply full-thickness coverage over drybase coat, and primer where required, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.09 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072419

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings.

1.02 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.

1.03 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.

1.04 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; dry film thickness; 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.

1.05 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 come into contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer to be licensed by ABAA according to ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly as indicated on Drawings, 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, building corner condition, 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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.08 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

2.01 MATERIALS

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

2.02 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to 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 to 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. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E2357.
- C. Assembly Water Infiltration: No leakage when tested to 15 pounds per square foot, when tested according to ASTM E331.
- D. Fastener Sealability: Passes ASTM D1970, Section 8.9.

2.03 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 15 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following manufacturers vapor-permeable air barrier systems:
 - a. Dow; DEFENDAIR 200C Air and Weather Barrier Coating
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; GE Elemax 2600.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.0003 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E2178.

- b. Vapor Permeance: Minimum 7.9 perms ; ASTM E96/E96M, Procedure A, Desiccant Method, 10.2 perms Procedure B, Water Method.
- c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
- d. Adhesion to Substrate: Minimum 30 lbf/sq. in. (207 kPa) or to substrate failure for glass-mat gypsum sheathing when tested according to ASTM D4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.04 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and 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.
- B. Primer: Liquid primer recommended for specific substrates by air-barrier material manufacturer.
- C. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; UltraSpan.
 - b. The Dow Chemical Company; DOWSIL .

PART 3 - EXECUTION

3.01 COORDINATION

- A. Coordinate installation of air-barrier material with sealant installations at perimeter of exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings. Air-barrier material installation to be complete and accepted prior to installation of perimeter sealants.
 - 1. Coordinate work to extend air barrier assembly beyond face of door, curtain wall, storefront, and louver frames as indicated in Drawings.
 - 2. Refer to sections 079100 – “Preformed Joint Seals” and 079200 – “Joint Sealants” for additional information on perimeter sealant materials and locations of use.
- B. Coordinate work to extend air barrier assembly 6 inches (150 mm) under through-wall flashings at copings.

3.02 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 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.
1. Prepare joints and edges in glass-mat gypsum sheathing with system recommended flashing material and accessory materials.
 - a. Provide reinforced joint treatment at joints greater than 1/2 inch (13-mm) in width and when covering cut edge of gypsum panels.
- B. Mask off adjoining surfaces not covered by air barrier 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 in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Provide reinforced joint treatment at changes in substrate plane, sharp corners and edges to form a smooth transition from one plane to another.

3.04 PRE-APPLICATION ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
1. Coordinate the installation of air barrier with installation of roofing membrane and flashings, base flashing, and foundation waterproofing systems to ensure continuity of air barrier with roofing membrane.
 2. Install transition strips to receive self-adhering flashing materials of membrane roof system. Provide transition strip width required to allow a minimum of 3 inches (75 mm) of coverage of each material and each substrate.
 3. Apply primer over substrates as recommended by manufacturer to achieve required adhesion to substrate.
 - a. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

- B. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- C. Install backer rod and sealant at perimeter of aluminum fittings of rain-screen glazing system. Recess backer rod from face of sheathing a distance equal to 1/2 the joint width. Install silicone joint treatment over joint, extending silicone seal minimum of 1 inch (25 mm) beyond sheathing onto bracket surfaces.
- D. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- E. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.05 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips, transition strips and sealant assemblies to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow manufacturer's required drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions.
 - 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one sprayed coat or two equal roller applied coats . Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Do not cover air barrier until installation has been reviewed by Architect and Owner to determine if installation shall be tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.06 POST-APPLICATION ACCESSORIES INSTALLATION

- A. Preformed Silicone Extrusions/Strips: Prime concealed, perimeter surfaces of windows, curtain walls, storefronts. Select size of preformed silicone extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter metal surfaces, with not less than 1 inch (25 mm) of full contact.

1. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
 2. Install at transitions from air barrier to metal flashing receivers for membrane roof counterflashing specified in section 076200 – “Sheet Metal Flashing and Trim”.
- B. At end of each working day, seal top edge of strips and transition strips to substrate with silicone sealant.

3.07 FIELD QUALITY CONTROL

- A. General: Conduct tests of installed assemblies to confirm the execution and workmanship of the installation will meet the requirements for performance.
- B. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- C. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- D. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Air-barrier dry film thickness.
 3. Continuous structural support of air-barrier system has been provided.
 4. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 5. Termination mastic has been applied on cut edges.
 6. Strips and transition strips have been firmly adhered to substrate.
 7. Compatible materials have been used.
 8. Transitions at changes in direction and structural support at gaps have been provided.
 9. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 10. All penetrations have been sealed.
- E. Tests: As determined by testing agency from among the following tests:
1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers. Conduct tests in Welcome Center in two phases, dividing the building into two volumes along the north wall of the exhibit space. Provide separate tests and reports for each phase.
 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783.
 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.
- F. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- H. Prepare test and inspection reports.

3.08 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 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.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Concealed-fastener, lap-seam metal wall panels.

- B. Related Sections:

- 1. Section 074213.23 "Metal Composite Material Wall Panels" for metal-faced composite wall panels.

1.03 PREINSTALLATION MEETINGS

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

- 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of windows.
 - 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 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 panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.04 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 each type of panel and accessory.
 - B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
 - C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- 1.05 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
 - C. Field quality-control reports.
 - D. Sample Warranties: For special warranties.
- 1.06 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panels to include in maintenance manuals.
- 1.07 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 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 metal panel assembly as shown on Drawings, including corner, interface with storefront framing, supports, 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.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

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

1.09 FIELD CONDITIONS

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

1.010 COORDINATION

- A. Coordinate metal panel installation with installation of fluid-applied membrane air barriers, rain drainage work, flashing, trim, construction of roofs, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.011 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal 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 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 Delta E 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

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company ; Flush wall panels. or a comparable product by one of the following:
 - a. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.; Flush Panel.
 - b. ATAS International, Inc.; DWF120.
 - c. Metal Sales Manufacturing Corporation; Soffit Panel.
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.028 inch (0.71 mm).

- b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: White.
- 3. Panel Coverage: 12 inches (305 mm).
 - 4. Panel Height: 1.0 inch (25 mm).

2.03 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal 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, caps, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.04 FABRICATION

- A. Fabricate and finish metal 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. Provide panel profile for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. 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. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. 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.

2.05 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. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (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

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that fluid-applied membrane are barrier has been installed over substrate to prevent air infiltration or water penetration.

- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Miscellaneous Supports: Install miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb metal panels to substrates.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until membrane air barriers and flashings that will be concealed by metal 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 panel work proceeds.
 - 6. Do not splice panels. Extend panels in single sections from sill to head trim.
 - 7. Align bottoms of metal panels. Fasten adjacent panels at sill trim with blind rivets painted to match finish of panel. 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. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use 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 panel manufacturer.
- D. Watertight Installation:
 - 1. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
- E. 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 panel system including trim, corners, flashings, sealants, gaskets, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

- F. 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 achieve waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.04 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Remove metal shavings from self-drilling fasteners, or pre-drilling holes, from sill trim and roof with vacuum daily. Rust stains on finished surfaces are not acceptable.
- C. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal composite material (MCM) panels.
2. Metal composite material (MCM) systems.

B. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.

1.02 DEFINITIONS

A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

B. PER: Pressure-equalized rainscreen system designed for no water intrusion, with equal pressure within air cavity and outside cladding barrier.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, MCM system Installer, MCM system manufacturer's representative, and installers whose work interfaces with or affects MCM 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 MCM system 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 MCM system.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for system 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.

1.04 ACTION SUBMITTAL

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel, system, and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of MCM system; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
3. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples for Verification: For each type of MCM panel and MCM system required, with factory-applied color finishes.

1. MCM Panel: Manufacturers' standard size.
2. MCM System: Minimum 12 inches (305 mm) long by 12 inches (305 mm) wide, fabricated into panel systems indicated. Include fasteners, closures, and other MCM panel accessories. Panel sample need not be provided in the specified color.

D. Delegated Design Submittals: For MCM system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each MCM system, for tests performed by qualified testing agency or by the manufacturer and witnessed by a qualified testing agency.
 - a. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - b. Fabricator's MCM System Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - 1) PER System: Tested to AAMA 508.
2. Preconstruction Test Reports: For MCM system.

B. Qualification Statements: For manufacturer of panel material, fabricator of panels and system, and Installer.

C. Delegated design engineer qualifications.

D. Sample warranties.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For MCM panels.
- B. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.07 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Minimum 10 years' experience.
 - 2. Fabricator: Certified MCM fabricator by the Metal Construction Association.
 - 3. Installer: Entity that employs installers and supervisors who are trained and approved by MCM system manufacturer.
 - 4. Delegated Design Engineer: A professional engineer who is legally qualified to practice in the State of Indiana and who is experienced in providing engineering services of the type indicated.
 - 5. Testing Agency: An agency acceptable to authorities having jurisdiction.

1.08 MOCKUPS

- A. Build mockups to set quality standards for fabrication and installation.
 - 1. Build mockup at location agreed to through the submitted and approved shop drawings. Fabricator to propose mock-up location on Welcome Center that includes base, corner, soffits, supports, attachments, and accessories.
 - 2. Remove mock-ups that are rejected and coordinate repairs to fluid-applied membrane air barriers and substrates prior to installation of subsequent mock-ups.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

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

1.010 FIELD CONDITIONS

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

1.011 COORDINATION

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

1.012 WARRANTY

- A. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels 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: 10 years from date of Substantial Completion.

- B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM 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 in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with 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.

- C. MCM System Warranty: Fabricator's standard form in which manufacturer agrees to repair or replace components of MCM systems that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design MCM system.

- B. Structural Performance: MCM systems to withstand the effects of the following loads, based on testing in accordance with ASTM E330/E330M:

1. Wind Loads: Specific component design wind pressures shall be calculated by supplier's engineer based on Design Loads for Structural Frame and Design Wind Load Criteria for Cladding and Cladding Backup, as provided in Drawings.
 2. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested in accordance with ASTM E283/E283M at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 15 psf (720 Pa).
- E. Pressure Cycling: Provide PER system with a pass rating in accordance with AAMA 508.
1. Lag between the cavity and the cyclic wind pressure to not exceed 0.08 seconds.
 2. Maximum differential between the cavity and the cyclic wind pressure to not exceed 50 percent of the maximum test pressure.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 METAL COMPOSITE MATERIAL (MCM) WALL PANELS

- A. Metal Composite Material (MCM) Wall Panels: Provide MCM panels fabricated from two metal facings bonded to a solid, extruded thermoplastic core.
1. Basis-of-Design Product: Subject to compliance with requirements, provide ALUCOBOND; 3A Composites USA, Inc ; ALUCOBOND PLUS. or a comparable product, with custom colors where specified, by one of the following:
 - a. ALPOLIC Materials; Mitsubishi Chemical Composites.
 - b. Arconic.
 2. Core: FR.
 3. Panel Thickness: 0.157 inch (4 mm).
 4. Bond Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
 5. Fire Performance: Flame-spread index less than 75 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.
- B. MCM Panel Materials:
1. Aluminum-Faced Panels: ASTM B209 alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- (0.50-mm-) thick, aluminum sheet facings.
- C. Coil-Coated Aluminum Finish:

1. PVDF Fluoropolymer: AAMA 2605, fluoropolymer finish of type indicated, 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.
 - a. Exterior Finish Type and Color.
 - 1) Panel No. 1: Mica fluoropolymer finish: Color to match Architect's sample, equal to Alucobond BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.
 - 2) Panel No. 2: Three-coat fluoropolymer finish. Color to match Architect's sample, equal to Alucobond BN8A1156 PPG Duranar The Classic Collection, "Silver Metallic".
 - 3) Panel No. 3: Two-Coat PVDF: Fluoropolymer finish. Color to match Architect's sample, equal to PPG Duranar "Bone White" UC43350.

2.03 METAL COMPOSITE MATERIAL (MCM) SYSTEM

- A. PER MCM System: Provide factory-formed and -assembled, MCM panels formed into profile for PER system installation, drained at horizontal joints and at base of wall. Include attachment assembly components, panel stiffeners, and accessories required for compartmentalized and weathertight system.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sobotec; SL2000 Dry Joint Filler System or a comparable product by one of the following:
 - a. Ameri clad Quality Metalcrafts; AC-1200 PE Dry Set Composite Panel System.
 - b. CEI Materials, LLC R3000 Pressure Equalized Rain Screen System.
- B. System Panel Depth: As indicated by manufacturer's designations, and as indicated on drawings.
- C. Attachment Assembly Components: Manufacturer's standard system of clips, tracks and channels formed from extruded aluminum.
- D. Labeling: Comply with labeling requirement of applicable building code.

2.04 ACCESSORIES

- A. Metal Subframing and Furring: ASTM C955 cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of MCM system.
- B. System Special Shapes and Accessories: Provide panel components required for a complete, weathertight wall system including trim, copings, sills, corner units, clips, flashings, sealants, gaskets, weep baffles, and similar items. Match material and finish of MCM panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from 0.040 inch aluminum sheet material as required to seal against weather and to provide finished appearance. Locations indicated in

Drawing at bottom of panel conditions to drain water out over construction and maintain open drainage plane. Finish flashing and trim with same finish system and color as adjacent MCM panels.

- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.
 - 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.
 - 2. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

2.05 FABRICATION

- A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated panel performance requirements demonstrated by laboratory testing.
- B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.
 - 1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F (21 deg C). Allow for ambient temperature range at time of fabrication.
 - 2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
 - 3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
 - 4. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
 - a. Width: Plus or minus 0.079 inch (2 mm) at 70 deg F (21 deg C).
 - b. Length: Plus or minus 0.079 inch (2 mm) at 70 deg F (21 deg C).
 - c. Squareness: Plus or minus 0.079 inch (2 mm) at 70 deg F (21 deg C).
 - 5. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
 - 6. Attach routed-and-turned panel flanges to perimeter extrusions with manufacturer's standard fasteners.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions 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. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal manufacturer for application, but not less than thickness of metal being secured.
5. Coordinate tie in of flashing to fluid-applied membrane air barrier to maintain barrier to water infiltration behind flashings.

2.06 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 unacceptable. 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

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM system manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM system manufacturer.
 - a. Verify that fluid applied membrane air-barrier has been installed over sheathing or backing substrate to prevent air infiltration or water penetration and tied into flashings that are part of MCM system.
- B. Examine roughing-in for components and assemblies penetrating MCM system to verify actual locations of penetrations relative to seam locations of MCM panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF MCM SYSTEM

- A. General: Install MCM system in accordance with system manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports

unless otherwise indicated. Anchor MCM system securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving MCM system.
 2. Flash and seal MCM system at perimeter of all openings. Fasten with self-tapping screws.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as MCM system work proceeds.
 6. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 7. Provide weathertight escutcheons for all items penetrating system.
 8. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM system manufacturer.
 9. Attach MCM panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.
- B. Attachment Assembly, General: Install attachment assembly required to support MCM panels and to provide a complete weathertight wall system, including tracks, drainage channels, anchor channels, perimeter extrusions, and panel clips.
1. Where included in approved shop drawings, install subframing, furring, and other panel support members and anchorages in accordance with ASTM C955.
 2. Install support system at locations, at spacings, and with fasteners recommended by MCM system manufacturer to meet listed performance requirements.
- C. PER MCM System: Install vertical and horizontal system components required to provide compartmentalization at locations, at spacings, and with fasteners recommended by system manufacturer.
1. Attach MCM panels by interlocking panel perimeter extrusion into channels of system support extrusion.
 2. Insert matching MCM spline into channels at joint reveal locations.
- D. Install panels to allow individual panels to "free float".
- E. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install accessory components required for a complete MCM system. .
- F. 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 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 ft. (3 m) with no joints allowed within 24 inches (605 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.03 INSTALLATION TOLERANCES

- A. Shim and align MCM panels within installed tolerance of 1/4 inch in 20 ft. (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.04 CLEANING

- A. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.05 PROTECTION

- A. Replace MCM 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 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Adhered polyvinyl chloride (PVC) roofing membrane over adhered coverboard over mechanically fastened insulation over metal deck.
2. Adhered polyvinyl chloride (PVC) roofing membrane over adhered coverboard over mechanically fastened insulation over plywood roof deck.
3. Accessory roofing materials.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for premanufactured copings and roof edge flashings.
6. Section 077200 "Roof Accessories" for premanufactured roof hatches and curbs.
7. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
8. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.02 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site following completion of submission and approval of required action and informational submittals. Document proceedings, including corrective measures or actions required and furnish copy of record to each participant..

1. Meet with Owner, Architect, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment. Document decisions, actionable items, corrective measures and distribute meeting notes to participants.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review product data for proposed roof system.
7. Review perimeter membrane terminations, base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
8. Review installation of metal counterflashings and receivers.
9. Review governing regulations and requirements for insurance and certificates if applicable.
10. Review temporary protection requirements for roofing system during and after installation.
11. Review roof observation and repair procedures after roofing installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes and total thickness of assemblies.
 5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 6. Tie-in with air barrier.
- C. Samples for Verification: For the following products:
 1. Roof membrane and flashing, of color required.
 2. Walkway pads or rolls, of color required.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field Test Reports:
 1. Concrete internal relative humidity test reports.
 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.07 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturers: A qualified manufacturer that is UL listed or listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
 2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.09 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight. Where Manufacturer's tested assembly varies from the requirements of this section, Contractor shall proceed as follows:
 - 1. If manufacturer's tested assembly requires materials whose characteristics exceed those specified in this Section in order to meet specified performance and warranty requirements, or provide compatibility between Manufacturer's proprietary materials, Contractor shall provide the material required by the tested assembly.
 - 2. If roof system or an individual component specified in this Section exceeds that of manufacturer's minimum assembly tested to meet specified performance and warranty requirements, Contractor shall provide the system or components specified.
 - 3. If Contractor wishes to propose or bid alternative roof assembly, that assembly and associated test data must be submitted 14 days prior to receipt of bid and incorporated by specific reference by addendum.
- B. Provide roof assemblies compliant with the following.
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- C. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.
- E. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested in accordance with ANSI/CRRC S100.
- F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.02 POLYVINYL CHLORIDE (PVC) ROOFING

- A. PVC Sheet Type II: ASTM D4434/D4434M, textured, glass-fiber reinforced.
 - 1. Manufacturers: Subject to compliance with requirements, provide the following product:
 - a. Sika Sarnafil; G-410-60 Textured.
 - 2. Thickness: 60 mils (1.5 mm).
 - 3. Exposed Face Color: Light Reflective Grey.
- B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.03 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
 - 1. Vertical flashing membrane may be smooth faced product compatible with textured field membrane.
 - 2. Detail membrane may be provided where manufacturer's standard details indicate its use.
- C. PVC Coated Sheet Metal: 0.024 inch T-304 stainless steel sheet with a 34 mil (.86 mm) unsupported PVC membrane laminated to one side, used to form flashing assemblies at perimeter of membrane roof assembly.
 - 1. Product: Sarnaclad- SS
- D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

- E. Bonding Adhesive, Option for Horizontal Field Membrane: Manufacturer's standard, water based.
 - 1. Product: Sika Sarnacol-2121.
- F. Bonding Adhesive, Vertical Flashing Membrane and Option for Horizontal Field Membrane: Manufacturer's standard, VOC compliant, solvent based.
 - 1. Product: Sika Sarnacol-2170.
- G. Low-Rise, Urethane, Cover Board Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
 - 1. Product: Sika Sarnacol-2163 Adhesive.
 - 2. Color: White.
- H. Concealed Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- I. Exposed Metal Termination Bars: Basis of Design: Metal Era Extruded Termination Bar With Cover (CB-175, CF-175)
 - 1. Cover Material: 0.040 inch aluminum.
 - 2. Color of Cover: White
- J. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.04 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. (23-kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength, square edged.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kingspan Insulation LLC.
 - b. Owens Corning.
 - c. The Dow Chemical Company.
 - 2. Thermal Resistance: R-value of 5.0 per 1 inch (25.4 mm).

3. Size: 48 by 48 inches (1219 by 1219 mm).
 4. Thickness:
 - a. Base Layer: 1-1/2 inches (38 mm).
 - b. Upper Layer: As required to provide assemblies indicated in Drawings.
- C. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 3, glass-fiber mat facer on both major surfaces.
1. Minimum Compressive Strength: 24 psi (172kPa).
 2. Size: 48 by 48 inches (1219 by 1219 mm).
 3. Thickness:
 - a. Base Layer: 1-1/2 inches (38 mm).
 - b. Upper Layer: As required to provide assemblies indicated in Drawings.
- D. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: Match roof insulation.
 2. Minimum Thickness: 1/4 inch (6.35 mm).
 3. Slope:
 - a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.05 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cover Board to Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum LLC.; DensDeck Prime Roof Board.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell FA™ Glass Mat Roof Board.
 - c. USG Corporation; Securock UltraLight Coated Glass-Mat Roof Board.
 2. Thickness: 1/4 inch (6 mm).
 3. Surface Finish: Fiberglass facer, factory primed.
 4. High psi polyisocyanurate cover board is not an acceptable substitution.

2.06 WALKWAYS

- A. Flexible Walkways: Factory-formed, vinyl roof mat compatible with PVC membrane roof material with cross-directional top ribs in open-grid permitting water drainage across roof drainage pattern
 - 1. Size: Approximately 24 inch by 33-foot roll (10 by 0.6 m). 9/16-inch (14 mm) height.
 - 2. Color: Safety Yellow.
 - 3. Diamond cut pattern in top ribs to provide slip resistance.
 - 4. Basis-of-Design: Subject to compliance with specified requirements, provide Crossgrip PVC walkway matting by Plastex Matting Inc. or roof membrane manufacturer's private labeled equivalent product.

- B. Walkway Pad Used as Splash Pan: Nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.
 - 1. Size: Approximately 36 by 60 inches (914 by 1524 mm).

PART 3 - EXECUTION

3.01 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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.03 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.04 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 - 1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump as indicated in the Drawings.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - g. Loosely lay base layer of insulation units over substrate.
 - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - e. Trim insulation so that water flow is unrestricted.

- f. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
- g. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- h. Mechanically fasten insulation and tapered insulation assembly to metal deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification.

3.05 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.06 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.07 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.08 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 1. Install flexible walkways at the following locations:
 - a. Locations indicated on Drawings.
 - b. As required by roof membrane manufacturer's warranty requirements.
 2. Provide 6-inch (76-mm) clearance between adjoining pads.

3.09 INSTALLATION OF DOWNSPOUT WALKWAY PAD/SPLASH PAN

1. Provide 6-inch (76-mm) clearance between pad and wall.
2. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.010 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Low-slope roof sheet metal fabrications.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, and blocking. Section 042000 "Unit Masonry" for materials and installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
2. Section 075419 "Polyvinyl Chloride (PVC) Roofing" for installation of sheet metal flashing and trim integral with roofing.
3. Section 074213.13 "Formed Metal Wall Panels" for sheet metal flashing and trim integral with formed metal wall panels.
4. Section 074213.23 "Composite Metal Material Wall Panels" for sheet metal flashing and trim integral to composite metal material wall panel system.
5. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, and formed metal blocking that supports those systems.
6. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, and other manufactured roof accessory units.

1.02 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.03 PREINSTALLATION MEETINGS

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

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For each of the following
 - 1. Elastomeric sealant.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 3. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 4. Include details of termination points and assemblies.
 - 5. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless Steel Sheet: ASTM A240/A240M, Type 304 or Type 316, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) ASTM A480/A480M, No. 4 (polished directional satin).
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

2.03 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Self-locking rivets and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners.
 - a. Blind Fasteners: High-strength stainless steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- E. Reglets and Receivers: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with shop mitered corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Material: Stainless steel, 0.0188 inch (0.477 mm) thick.
 - 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 3. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 - 5. Accessories:
 - 6. Finish: Mill.

2.04 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Use lapped expansion joints for counterflashing.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Do not use graphite pencils to mark metal surfaces.

2.05 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Stainless Steel: 0.0188 inch (0.477 mm) thick.
- B. Flashing Receivers: Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch (0.396 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 - 5. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 - 6. Do not field cut sheet metal flashing and trim by torch.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - 1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

- C. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- D. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

3.03 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
 - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
 - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock top edge of roof counterflashing with continuous receiver.
 - 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

3.04 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.05 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.

3.06 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Formed metal blocking.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for downspout boots.
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
5. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. 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.

1.02 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 roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- 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 each color and texture specified.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

1.06 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge as shown on Drawings at location selected by Architect in field.
2. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Section 014000 "Quality Requirements".
3. Build mockup of each roof edge condition, including, copings, fascia, gutters and downspouts, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, and accessories.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 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-specialty installation.

1.08 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.

1.09 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075419 "Polyvinyl-Chloride (PVC) Roofing."
- B. Special Warranty on Painted Finishes: 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 Delta E 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

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to 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. FM Approvals' Listing: Manufacture and install copings and roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Storage Building.
 - 1) Metal-Era, Inc.: Perma-Tite Gold Cantilever Coping.
 2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch (1.27 mm) thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Mica fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat..
 - c. Color and Gloss: Match Architect's sample, custom spray finish to provide color and gloss equal to custom coil coat sample, PPG BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.
 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 4. Special Fabrications:
 - a. End cap sections at parapet walls of Storage Building.
 5. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.

2.03 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Welcome Center Vestibules.
 - 1) Metal Era, Inc.: Anchor-Tite Extended Fascia.
 - 2) Pac-Clad Peterson: PAC Extended Snap Edge Fascia.
 - b. Welcome Center Clerestories and Trucker Restrooms.
 - 1) ATAS International, Inc.: Rapid-Lock Extruded Fascia.
 - 2) Metal-Era, Inc.: Anchor-Tite Standard Fascia.
 - 3) Pac-Clad Peterson: PAC Snap Edge Fascia FA
 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.040 inch (1.02 mm) thick.

- a. Surface: Smooth, flat finish.
 - b. Finish Type and Color:
 - 1) At Welcome Center Vestibules:
 - a) Finish: Mica fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - b) Color and Gloss: Match Architect's sample, custom spray finish to provide color and gloss equal to custom coil coat sample, PPG BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.
 - 2) At Welcome Center Clerestory and Trucker Restroom Building:
 - a) Finish: Two-coat fluoropolymer.
 - b) Match Architect's sample, equal to PPG Duranar "Bone White" UC43350.
 - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 5. Receiver: Manufacturer's standard material and thickness.
- B. Roof Drip Edge Fascia: Manufactured, two-piece, roof drip-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal anchor bar with integral top at roof plane and drip-edge cleat to engage fascia cover. Anchor bar secures and seals to edge of single-ply roof membrane.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Metal Era; Anchor-Tite Drip Edge.
 - b. Atas; Drip Edge Fascia.
 - 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.040 inch (1.02 mm) thick.
 - a. Surface: Smooth, flat finish.
 - a. Finish Type and Color:
 - 1) At Storage Building:
 - a) Finish: Mica fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - b) Color and Gloss: Match Architect's sample, custom spray finish to provide color and gloss equal to custom coil coat sample, PPG BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.
 - 2) At Welcome Center Clerestory and Trucker Restroom Buildings:
 - a) Finish: Two-coat fluoropolymer.
 - b) Match Architect's sample, equal to PPG Duranar "Bone White" UC43350.

3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
4. Receiver: Manufacturer's standard material and thickness

2.04 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atas; Ultra HP Gutter
 2. Metal-Era, Inc.; Seal-Tite WR Gutter
 3. Pac-Clad Peterson; PAC-TITE Gold Gutters.
- B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Aluminum Sheet: 0.040 inch (1.02 mm) thick.
 2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
 3. Gutter Supports: Internal, concealed gutter brackets with finish matching the gutters.
 4. Gutter Accessories: Prefabricated expansion joint assemblies. Flat ends.
- C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.040 inch (1.02 mm) thick.
- D. Aluminum Finish Type and Color:
1. At Storage Building:
 - a. Finish: Mica fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - b. Color and Gloss: Match Architect's sample, custom spray finish to provide color and gloss equal to custom coil coat sample, PPG BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.
 2. At Welcome Center Clerestory and Trucker Restroom Building:
 - a. Finish: Two-coat fluoropolymer.
 - b. Match Architect's sample, equal to PPG Duranar "Bone White" UC43350.

2.05 FORMED METAL BLOCKING

- 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. Metal-Era, Inc.; Edge Box RI.
 2. Formed metal blocking may be site assembled using cold-formed structural track and strapping specified in section 054000 "Cold-Formed Metal Framing."

- B. Formed Metal Blocking: Fabricated nested or interlocking units formed to provide secure fastening of roof edge assemblies to adjacent construction. Provide assemblies of sizes and configurations indicated in Drawings, formed from the following metal sheet:
 - 1. Zinc-Coated Steel: Nominal 0.032-inch (0.85-mm) thickness.

2.06 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- C. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.07 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.
 - b. Grace Construction Products; W.R. Grace & Co. Conn.;Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Specialty Tile and Metal Underlayment.
 - g. Polyguard Products, Inc.; Deck Guard HT.
 - 2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F (116 deg C).
 - 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C).

2.08 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.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
- 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 joints with limited movement.

2.09 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted 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 unacceptable. 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. Coil-Coated Aluminum Sheet Finishes:
 - 1. Exposed Finish as specified for each Roof Specialty type.
 - 2. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.01 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.
 - 1. Verify in-place construction allows for installation of formed metal blocking and maintain alignment with adjacent construction.
- 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.

3.02 INSTALLATION OF FORMED METAL BLOCKING

- A. Field verify location of face of blocking indicated in Drawings with in-place construction. Align blocking to be straight, plumb and true with building lines and elevations, such as the top of parapet wall assemblies and roof edges.
- B. Fasten blocking to supporting construction with fasteners sized and spaced as required to resist design loads for windstorm classification specified.

1. Blocking parallel to flutes of metal deck: Provide edge channel formed to depth of metal deck and sized to provide flat surface for width of blocking assembly. Fasten to metal deck at spacing required by windload, but not greater than 16 inches O.C.
2. Blocking perpendicular to flutes of metal deck: Provide edge angle formed with vertical leg equal to depth of deck and horizontal leg of depth required to provide flat surface for width of blocking assembly. Fasten to metal deck with fastener required by windload at the top of each support deck flute.
3. Blocking installed over sheathing and metal stud wall assemblies: Fasten base member of blocking assembly through sheathing to metal studs with fastener required by windload with penetration of metal framing not less than 1 inch.
4. Blocking installed over plywood: Install strip of self-adhering sheet underlayment to separate metal blocking from wood materials. Fasten base member of blocking assembly through plywood with fastener required by windload with penetration of plywood not less than 1 1/2 inch.

3.03 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, underlayments, 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 weathertight 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 with self-adhering underlayment or by other permanent separation as recommended by manufacturer.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), 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 penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.04 INSTALLATION OF COPINGS

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
 - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements, but not greater than 40-inch (1016-mm) centers.

3.05 INSTALLATION OF ROOF-EDGE SPECIALTIES

- A. Install cleats 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.

3.06 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

- A. 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 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated.. 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 (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - 1. Hanger Style: Figure 1-35B in accordance with SMACNA's "Architectural Sheet Metal Manual".
 - 2. Provide elbows at base of downspouts that discharge onto low-slope roofs.
 - 3. Connect downspouts to underground drainage system where indicated.
- D. Parapet Scuppers: Install scuppers through parapet where indicated using materials specified in section 075419 "Polyvinyl-Chloride (PVC) Roofing". Install coping sections with end caps over turned-up sides of PVC coated metal and seal end cap to metal.

3.07 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. 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.
- D. 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

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladders for access to roof hatches.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, and miscellaneous sheet metal trim and accessories.
3. Section 077100 "Roof Specialties" for manufactured fasciae, copings, drip edges, gutters, and downspouts.

1.02 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

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

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.06 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories to 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. Wind-Restraint Performance: As indicated on Drawings.

2.02 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Greenheck Fan Corporation.
 - b. Pate Company (The).
 - c. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - d. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

- D. Aluminum: 0.125 inch (3.17 mm) thick sheet.
 - 1. Finish: Mill .
- E. Construction:
 - 1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof deck slope accommodated where present.
 - 5. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
 - 6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 7. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
 - 8. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
 - 9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- (19-mm-) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.03 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide BILCO Company (The); Thermally Broken Roof Hatch S 50TB or a comparable product by one of the following:
 - a. Architectural Specialties, Inc.
 - b. Babcock-Davis.
 - c. Milcor; a division of Hart & Cooley, Inc.
 - d. Nystrom.
 - e. Pate Company (The).
- B. Type and Size:
 - 1. Single-leaf lid, 30 by 36 inches (750 by 900 mm).
- C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
- D. Hatch Material, Aluminum:
 - 1. Thickness:

- a. Cover: 11 gauge (2.3 mm), thermally broken.
 - b. Liner: 18 gauge (1 mm)
 - c. Frame: 11 gauge (2.3 mm), thermally broken
2. Finish: Mill .
- E. Construction:
1. Insulation: 2-inch- (50-mm-) thick, polyisocyanurate board.
 - a. R-Value: 12.0 according to ASTM C1363.
 2. Hatch Lid: Opaque, insulated, and double walled, with metal liner of same material and finish as outer metal lid.
 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 4. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Height: 42 inches (1060 mm) above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized-steel tube, 1-5/8 inches (41 mm) in diameter.
 3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
 4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 7. Fabricate joints exposed to weather to be watertight.
 8. Fasteners: Manufacturer's standard, finished to match railing system.
 9. Finish: Manufacturer's standard.
 - a. Color: White.
- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches (1060 mm) above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.

2.04 METAL MATERIALS

- A. Aluminum Sheet: ASTM B209 (ASTM B209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
- B. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- C. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.
- D. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.
- E. Steel Tube: ASTM A500/A500M, round tube.
- F. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- G. Steel Pipe: ASTM A53/A53M, galvanized.

2.05 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWWA C2; not less than 1-1/2 inches (38 mm) thick in height or width.
- C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.06 GENERAL FINISH REQUIREMENTS

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

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Roof-Hatch Installation:
 - 1. Install roof-hatch over custom 8 inch (203-mm) tall curb anchored to roof deck.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach safety railing system to roof-hatch curb.
 - 4. Attach ladder-assist post according to manufacturer's written instructions.
- E. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.

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

END OF SECTION 077200

SECTION 079100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Prefinished, preformed, foam joint seals with field applied liquid sealant edge seals.
 - 2. Precured, extruded-silicone joint seals.

1.03 ACTION SUBMITTALS

- A. Product Data: For each preformed joint seal product including liquid sealant edge seals.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each preformed joint seal for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- B. Warranties: For special warranties.

1.05 QUALITY ASSURANCE

- A. Installer Qualification: Site foreman with a minimum prior experience of 2 completed prefinished, preformed joint seal projects.
- B. Products: Obtain liquid edge seal product and preformed joint seal product from same manufacturer.
- C. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.

1.06 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace preformed joint seals 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 agrees to furnish preformed joint seals 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PREFORMED, FOAM JOINT SEALS

- A. Preformed, Foam Joint Seals : Manufacturer's standard joint seal manufactured from modified acrylic impregnated open-cell polyurethane foam backing with factory-applied and cured silicone bellows on the exposed face and precoated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in stick form to fit joint widths based on design criteria indicated, with factory applied adhesive on one side for bonding to joint substrate.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. EMSEAL Joint Systems, Ltd; Colorseal/Seismic Colorseal, a division of Sika.
 - b. MM Systems; SCE Waterproof Expansion Joints.
 - 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+25 percent.
 - 3. Joint Seal Color: Up to three colors that match adjacent materials as selected by Architect from full range of manufacturer's colors.
 - 4. Edge Sealant: Silicone sealant for field application provided by manufacturer of, and in colors matching, prefinished, preformed foam joint sealant.

2.02 EXTRUDED-SILICONE JOINT SEALS

- A. Extruded-Silicone Joint Seals: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; UltraSpan US1100.
 - b. The Dow Chemical Company; DOWSIL 123 Silicone Seal.
 - 2. Joint Seal Width:

- a. Where used to seal metal flashing to fluid-applied membrane air barrier: 4 inches (102 mm).
 - b. Where used to seal over movement joint: Joint size indicated on Drawings plus 1 inch (25 mm).
3. Joint Seal Color: As selected by Architect from full range of industry colors, to match color selected for fluid-applied membrane air barrier.

2.03 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 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 seals. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 3. Clean fluid-applied membrane air barriers as recommended by manufacturer.

- B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 EXAMINATION

- A. Examine prepared joints substrates to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
 - 1. Do not proceed with installation of edge sealant under the following conditions.
 - a. When joint substrates are wet. Provide adequate time for surfaces to dry completely following times of fog, rain, or snow.
 - b. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C) whichever is more restrictive.
- B. Installation of Preformed, Foam Joint Seals:
 - 1. Install each length of seal immediately after removing protective wrapping.
 - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
- C. Installation of Edge Seal:
 - 1. Remove foreign material from substrates caused by primary sealant installation.
 - 2. Apply masking tape to face of substrates along edge of joint.
 - 3. Apply heal bead along edge of silicon finish of preformed joint seal providing continuous and even contact with adjacent substrate. Tool heal bead to form smooth face with flush transition to face of joint seal and substrate.
 - 4. Remove excess materials and masking tape from adjacent substrates.
- D. Installation of Precured, Extruded-Silicone Joint Seals:
 - 1. Apply masking tape to each side of joint, outside of area to be covered by seal system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone seal system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact with substrate.
4. Align sealant length to eliminate wrinkles, twists, or gaps in edge of precured seal.
5. Complete installation of seal 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.

3.05 PROTECTION

- A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
2. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification (Sealants not included in mock ups): For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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 color.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency and a qualified testing agency.
- B. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with

requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.08 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

- A. Special Installer's Warranty: 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 agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 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.

2.02 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. 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 C920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; SilPruf SCS2000N.
 - b. The Dow Chemical Company; Dowsil 756.
- C. Silicone, 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 C920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. GE Construction Sealants; UltraPruf II SCS2900.
 - b. The Dow Chemical Company; DowSil 790.

2.03 RETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Builders Solutions; MasterSeal NP 1.
 - b. Pecora Corporation; Dynatrol I-XL.
 - c. Sika Corporation - Building Components; Sikaflex®-201 US.
 - d. Tremco Incorporated; Dymonic 100.
- B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Sika Corporation - Building Components; Sikaflex®-219 LM.
- C. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use T and NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Master Builders Solutions; MasterSeal NP 2.
 - b. Pecora Corporation; Dynatred.
 - c. Sika Corporation; Joint Sealants; Sikaflex 2c NS EZ Mix.

2.04 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 C920, Type S, Grade NS, Class 25, Use NT.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - 2. PPG Paints; PPG Industries, Inc.; Top Gun 350 Acid Curing Silicone Sealant, 1419 Series.
 - 3. Pecora Corporation; Pecora 860.
 - 4. Soudal USA; RTV GP.
 - 5. The Dow Chemical Company; Dow Corning 786 Silicone Sealant.
 - 6. Tremco Incorporated; Tremsil 200.

2.05 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealant or Sealant Tapes: ASTM C1311.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Everkem Diversified Products, Inc.; Rubber Guard NS.
 - b. GSSI Sealants; EZ Trim Sealant Tape.
 - c. Pecora Corporation; Pecora BA-98.
 - d. Sika Corporation - Building Components; SikaLastomer 511 or SikaLastomer 95.

2.06 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE; Ultra Seal Pro Siliconized Acrylic Latex Caulk.
 - b. Pecora Corporation; AC-20.
 - c. PPG; 1413 Top Gun 140 Acrylic Sealant.
 - d. Sherwin-Williams Company (The); 950A Siliconized Acrylic Latex Caulk, White or PowerHouse Siliconized Acrylic Latex Sealant.
 - e. Tremco Incorporated; Tremflex 835.

2.07 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type O (open-cell material), or Type B (bicellular material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.01 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 performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.

- c. Limestone.
- 3. Remove laitance and form-release agents from concrete.
- 4. 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. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- 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.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 C1193 unless otherwise indicated.

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 manufacturers of joint sealants and of products in which joints occur.

3.05 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in concrete unit masonry in equipment courtyards.
 - c. Joints in anchored stone masonry veneer.
 - d. Joints between metal composite material wall panels and anchored stone masonry veneer or concrete unit masonry.
 - e. Joints between anchored stone masonry veneer and structural steel framing.
 - f. Joints in exterior insulation and finish systems and between finish system and adjacent materials.
 - g. Perimeter joints between anchored stone masonry and frames of doors, storefront framing, and louvers.
 2. Joint Sealant: Urethane: M, NS, 25, T, NT.
 3. Joint-Sealant Color:
 - a. At joints in and adjacent to anchored stone masonry, as selected by Architect from manufacturer's full range of colors, to match mortar color.
 - b. At joints in and adjacent to exposed concrete unit masonry, as selected by Architect from manufacturer's full range of colors, to match mortar color.
 - c. At other joints, as selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Bed and head joints in limestone coping.

2. Joint Sealant: Urethane: S, NS, 100/50, T, NT
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors, to match limestone mortar color.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Non-rainscreen joints between metal composite material wall panels.
 - b. Perimeter joints between metal composite material wall panels and frames of doors, windows or insulated panels of edge-clamped flush-glazed curtain walls or skylights and perimeter flashing.
 - c. Joints between formed metal wall panel trim and gutters.
 - d. Joints between formed metal wall panels and storefront framing.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 3. Joint-Sealant Color:
 - a. At joints in formed metal wall panels, white to match panels.
 - b. At joints adjacent to metal composite material wall panels, as selected by Architect from manufacturer's full range of colors to match panels.
- D. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between fluid-applied membrane air barrier and metal except where other joint materials are indicated.
 - b. Joints between fluid-applied membrane air barrier and metal brackets penetrating barrier and supporting glass rainscreen assembly.
 - c. Joints between insulated panels of edge-clamped flush-glazed curtain walls or skylights and perimeter flashing.
 2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT.
 3. Joint-Sealant Color:
 - a. At joints in fluid-applied membrane air barrier, grey to match air barrier.
 - b. At joints between insulated panels of edge-clamped flush-glazed curtain walls or skylights and perimeter flashing, as selected by Architect from manufacturer's full range of colors to match panels.
- E. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation and control joints in cast-in-place concrete slabs.
 2. Joint Sealant: Urethane, S, NS 25, T, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:

- a. Tile control and expansion joints.
 - b. Vertical joints on exposed surfaces of unit masonry and concrete tunnel walls.
 - c. Joints between structural steel frames supporting glazing systems and gypsum board.
 - d. Joints between structural steel frames supporting glazing systems and solid surface window sills.
 - e. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, M, NS, 25, NT.
 3. Joint-Sealant Color: .
 - a. Where adjacent to painted gypsum board or concrete unit masonry, white, to be painted to match adjacent surfaces.
 - b. Where adjacent to tile, color selected by Architect from manufacturer's full range of colors to match tile.
 - c. Where adjacent to solid surface, color selected by Architect from manufacturer's full range of colors to match solid surface.
 - d. Where located in tunnel; grey.
- G. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors and interior windows and
 - b. Between gypsum board and ground face concrete unit masonry.
 - c. Between gypsum board and concrete unit masonry to be painted.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: White, to be painted to match adjacent gypsum board or painted concrete masonry surfaces.
- H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color:
 - a. At porcelain plumbing fixtures: White.
 - b. At stainless steel plumbing fixtures; Clear.
 - c. At Tile: As selected by Architect from manufacturer's full range of colors.
- I. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: Gray.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Interior custom hollow-metal doors for sliding doors.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.02 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.03 COORDINATION

- A. Coordinate anchorage installation 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. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 7. Details of anchorages, joints, field splices, and connections.
 8. Details of accessories.
 9. Details of moldings, removable stops, and glazing.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door; AADG, Inc.; ASSA ABLOY.
 2. Curries, AADG, Inc.; ASSA ABLOY Group.
 3. Republic Doors and Frames; an Allegion brand.
 4. Steelcraft; Allegion plc.

2.02 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

- a) Type: As indicated in the Door and Frame Schedule.
- b) Thickness: 1-3/4 inches (44.5 mm).
- c) Face: Uncoated or metallic-coated steel sheet as indicated in Drawings, minimum thickness of 0.053 inch (1.3 mm).
- d) Edge Construction: Model 1, Full Flush or Model 2, Seamless.
- e) Edge Bevel: Provide manufacturer's standard beveled lock edge.
- f) Core: Kraft-paper honeycomb.

2. Frames:

- a) Materials: Uncoated or metallic-coated steel sheet as indicated in Drawings, minimum thickness of 0.053 inch (1.3 mm).

3. Construction: Full profile welded.

C. Exposed Finish: Prime.

A. INTERIOR CUSTOM HOLLOW-METAL DOORS FOR SLIDING DOORS: Commercial Laminated Doors: NAAMM-HMMA 867; ANSI/SDI A250.4, Physical Performance Level A. At locations indicated in the Door and Frame Schedule to receive sliding door assemblies.

1. Doors:

1. Type: Sliding doors to receive printed acrylic art panels and sliding door hardware.
2. Thickness: 1-3/4 inches (44.5 mm).
3. Face: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
4. Edge Construction: Continuously welded, filled and ground, with no visible seam.
5. Edge Bevel: None. Provide doors with square edges.
6. Core: Kraft-paper honeycomb.
7. Top Channel Filler: 0.053-inch (1.3 mm) steel with continuous steel reinforcement plate to receive sliding door hardware.
8. Bottom Channel: No filler. Open channel to receive door guide channel.

2. Exposed Finish: Prime.

2.03 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's welded-in-place, full-frame width, spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
1. For anchors at galvanized frames, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.04 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.05 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

- b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 2. Provide fixed frame moldings on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.06 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.02 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - 3. Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.03 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081119 – STAINLESS-STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

- 1. Stainless steel toilet stall doors and frames.

B. Related Requirements:

- 1. Section 087100 "Door Hardware" for door hardware for stainless steel doors.

1.03 COORDINATION

- A. Coordinate anchorage installation for stainless steel 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. Coordinate requirements for installation of door hardware.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, core descriptions, and finishes.

- B. Shop Drawings: Include the following:

- 1. Elevations of each door type.
- 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 each different wall opening condition.
- 6. Details of anchorages, joints, field splices, and connections.
- 7. Details of accessories.

- C. Samples:
 - 1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
- D. Product Schedule: For stainless steel doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver stainless steel doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store stainless steel doors and frames under cover at Project site with head up. Place units on minimum 4-inch- (100-mm-) high wood blocking.
- D. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ceco Door; AADG, Inc.; ASSA ABLOY; Stainless-Tech Doors.
 - b. Curries, AADG, Inc.; ASSA ABLOY Group.; Stainless Door and Frames
 - c. Steelcraft; Allegion plc.; LS Series Stainless Steel Doors; FS Series Stainless Steel Frames.

2.02 STAINLESS STEEL DOORS AND FRAMES

- A. Construct stainless steel door and frame assemblies to comply with NAAMM-HMMA 866 for the application indicated, including materials, fabrication methods, hardware reinforcement, tolerances, and clearances, and as specified. Comply with SDI ANSI/A250.4, for Physical Performance Level A.
- B. Doors and Frames: At locations indicated in the Door and Frame Schedule.
 - 1. Stainless Steel Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face Sheets: Type 316 stainless steel sheet, minimum thickness 0.062 inch (1.59 mm).
 - d. Edge Construction: Continuously welded with no visible seam.

- e. Top and Bottom Edges: Closed with continuous stainless steel channels with minimum thickness of 0.050 inch (1.27 mm), welded to face sheets or installed with concealed fasteners.
- f. Core Construction: Polyisocyanurate, polystyrene, or polyurethane laminated to face sheets.

2. Stainless Steel Frames:

- a. Materials: Type 316 stainless steel sheet.
- b. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from stainless steel sheet, minimum thickness 0.062 inch (1.59 mm).
- c. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from stainless steel sheet, minimum thickness 0.078 inch (1.98 mm).
- d. Construction:

1) Frames for toilet stall doors: Partial length single rabbet door frames.

- a) Provide continuous stainless steel cleat to retain one edge of door frame.
- b) Prepare frames for existing wall anchor installation with wall anchors centered in the hinge preparation on the hinged side, and aligned with center of hinge preparation on strike side.
- c) Provide tamper resistant hex drive stainless steel bolts in stainless steel masonry inserts to anchor frame.
- d) Provide top and bottom frame caps, continuously welded with no visible seam.

e. Cased opening frames: Full profile welded.

1) Provide masonry wire frame anchors to grout into concrete unit masonry.

- 3. Hardware Reinforcement: Stainless steel sheet.
- 4. Finish: ASTM A480/A480M No. 4, Directional Satin.

2.03 MATERIALS

- A. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, Type 304.
- B. Foam-Plastic Insulation: Manufacturer's standard polystyrene or urethane board insulation with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within door.
- C. Mineral-Fiber Insulation: Insulation made of rock-wool fibers, slag-wool fibers, or glass fibers.
- D. Inserts, Bolts, and Anchor Fasteners:
 - 1. Stainless steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts.

2.04 FRAME ANCHORS

- A. Provide anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
- B. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter stainless steel flat head hex drive bolts for use with shallow hole female threaded inserts. Provide stainless steel pipe spacer welded to frame preparation.
- C. Number and Spacing:
 - 1. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.
 - 2. Postinstalled Expansion Type: Locate anchors as indicated in details in Drawings.
- D. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to slab under terrazzo.
- E. Material:
 - 1. Stainless steel.

2.05 FABRICATION

- A. Stainless Steel Door Fabrication: Provide doors rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - 1. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 866.
- B. Stainless Steel Frame Fabrication: Provide stainless steel frames rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - 1. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 866.
 - 2. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - 3. Provide countersunk, flat-, or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 4. Door Silencers: Except on weather-stripped and gasketed frames, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Partial Height Single-Door Frames: Drill stop in strike jamb to receive two door silencers.
 - 5. Grouted Frames:
 - a. Plaster Guards: Weld guards to frame at back of hardware mortises and mounting holes in frames to be grouted.

- b. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- C. Hardware Preparation: Factory prepare stainless steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule, and templates.
 - 1. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 - 2. Comply with ANSI/BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.06 FINISHES

- A. Stainless Steel Finishes: Remove tool and die marks and stretch lines, or blend into finish. Grind and polish surfaces to produce uniform finish, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Grain Direction: For finishes exhibiting grain, run grain vertically on door faces and frame jambs.

2.07 ACCESSORIES

- A. Grout: Comply with ASTM C476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C143/C143M.
- B. Mineral-Fiber Insulation: Insulation made of rock-wool fibers, slag-wool fibers, or glass fibers.

PART 3 - EXECUTION

3.01 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 and with installation spreaders in place, adjust and securely brace stainless steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.02 INSTALLATION

- A. Install stainless steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with approved Shop Drawings and with manufacturer's written instructions.

- B. Stainless Steel Frames:
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - 2. Floor Anchors: Secure with stainless steel postinstalled expansion anchors.
 - 3. Solidly pack mineral-fiber insulation inside frames.
 - 4. In-Place Concrete or Masonry Construction: Secure frames in place with specified stainless steel postinstalled anchors.
 - 5. Installation Tolerances: Adjust stainless steel frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

3.03 ADJUSTING AND CLEANING

- A. Clean grout and other bonding material off stainless steel doors and frames immediately after installation.

- B. Stainless Steel Touchup: Immediately after erection, smooth any scratched or damaged areas of stainless steel; polish to match undamaged finish.

END OF SECTION 081119

SECTION 081613 - FIBERGLASS DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:

1. Fiberglass Reinforced Plastic (FRP) door.
2. Fiberglass Resin Molded Door frames.
3. Installation of door hardware furnished by others.

- B. Related Requirements:

1. Division 8 Section "Door Hardware" for door hardware for FRP doors.

1.03 COORDINATION

- A. Coordinate anchorage installation for fiberglass 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. Coordinate requirements for installation of door hardware, electrified door hardware, and Owner's access control Contractor.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, core descriptions, and finishes.

- B. Schedule: Provide a schedule of fiberglass door and framework prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

- C. Shop Drawings: Include the following:

1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and fiberglass thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and fiberglass thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of electrical raceway and preparation for electrified hardware.
 7. Details of anchorages, joints, field splices, and connections.
 8. Details of accessories.
 9. Details of moldings, removable stops, and glazing.
- D. Samples for Initial Selection: For units with factory-applied color finishes, provide samples of standard and optional colors.
- E. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fiberglass work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide individual unit packaging to prevent damage to factory-finished units.
- B. Deliver bonded fiberglass frames with two removable spreader bars across bottom of frames.
- C. Store fiberglass work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked assembly to permit air circulation.

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace fiberglass doors and frames that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of door.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 2. Warranty Period:
 - a. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Chem Pruf Door Co., Ltd.
 - 2. Corrim Company;
- B. Source Limitations: Obtain fiberglass work from single source from single manufacturer.

2.02 GENERAL

- A. Provide fiberglass components with a flame spread index of 25 or less when tested according to ASTM E 84 and self-extinguishing when tested according to ASTM D635.
- B. Provide fiberglass components accepted by USDA for food processing applications.

2.03 DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames:
 - 1. Physical Performance: ANSI A250.4: 1,000,000 or more cycles.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Smooth 0.125 inch (3.18mm) thick FRP sheet with gel-coat finish.
 - d. Edge Construction: Seamless, with no visible seams or joints at the door edge or face.
 - e. Core for Exterior Doors: Manufacturer's polyurethane foam core with a minimum R value of 11.
 - f. Internal Reinforcement:
 - 1) Provide stile and rail tube or channel construction within core at perimeter of door.
 - 2) Provide fiberglass tubes, plates, or solid blocking at hardware connection locations.
 - 3. Frames:
 - a. Materials: Fiberglass formed by pultrusion or resin transfer resulting in a one-piece section with a molded stop integral to the section.
 - b. Thickness: Minimum of 0.1875 inch (4.76 mm).
 - c. Construction: Full profile bonded, or resin welded.

2.04 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Construction Type: Provide one of the following options.
 - a. Adjustable Strap-and-Stirrup or T-shaped anchors: Sized to suit frame size, not less than 0.1875 inch (4.76 mm) thick, with perforated straps not less than 2 inches (51 mm) wide by 6 inches (152 mm) long. Fabricate from steel sheet complying with ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B or fiberglass sheet matching material of doors and frames.
 - b. Wire anchors: Fabricated from hot dipped galvanized steel wire not less than 0.177 inch (4.5 mm) thick, extending into masonry wall.

2.05 MATERIALS

- A. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- B. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.06 FABRICATION

- A. Fabricate fiberglass doors and frames to be rigid and free of defects, warp, or buckle. Accurately fabricate fiberglass to required sizes and profiles. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment
- B. Fiberglass Doors:
 1. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
 2. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels.
 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- C. Fiberglass Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint.
 1. Provide tamper-proof, countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Grout Guards: Bond guards to frame at back of hardware mortises in frames to be grouted.
 3. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Masonry Construction Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
- 4. Door Silencers: Door silencers are not required for weather-stripped frames of exterior doors.
- D. Hardware Preparation: Factory prepare fiberglass doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule, and templates provided by door hardware supplier.
 - 1. Reinforce fiberglass doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Reinforce fiberglass doors and frames with fiberglass reinforced plastic angles, plates, and solid polymer bars bonded to the assembly. Drill, tap and otherwise prepare doors and frames to receive door hardware in factory.
 - 3. Install door hardware in factory to the greatest extent practical.

2.07 FINISHES

- A. Factory Finish: 25 mil gelcoat finish with integral color.
 - 1. Color and Gloss:
 - a. Color: As selected by Owner or Owner's Representative from manufacturer's full range of standard and optional colors.
 - b. Gloss: Matte.

2.08 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.1875 inches (4.76 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Coordinate and verify completion of electrical raceway serving electrified hardware prior to wall installation.

- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove shipping spreaders installed at factory. Restore exposed finish as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install fiberglass doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Fiberglass Frames: Install fiberglass frames for doors of size and profile indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by bonding face joint continuously. Make splice smooth, flush, and invisible on exposed faces.
 - b. Install doors and frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 3. Installation Tolerances: Adjust fiberglass door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Fiberglass Doors: Fit fiberglass doors accurately in frames, within clearances specified below. Shim, as necessary.

1. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
2. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
3. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
4. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

3.04 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 work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from work immediately after installation.

END OF SECTION 081613

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulated service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.02 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.06 WARRANTY

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and the Indiana Building Code.
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
3. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20-lbf/sq. ft. (960-Pa) wind load, acting inward and outward.

2.03 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cornell Cookson company; Thermiser Max Insulated Rolling Door.
 - b. Overhead Door Corporation; Advanced Rolling Steel Service Doors 626.
 - c. Raynor Garage Doors; DuraCoil™ HP.
 - d. Wayne Dalton; a division of Overhead Door Corporation; Model 800C ADV.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to IECC requirements.
- D. Insulated Door Curtain R-Value: Minimum of 7 deg F x h x sq. ft./Btu (0.792 K x sq. m/W).
- E. Insulated Door Assembly U-Factor: 0.90 Btu/deg F x h x sq. ft. (5.1 W/K x sq. m).
- F. Door Curtain Material: Aluminum.
- G. Door Curtain Slats: Flat profile slats of 3-1/4-inch (83-mm) center-to-center height.
 1. Insulated-Slat Interior Facing: Metal.
 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from stainless steel or aluminum extrusions and finished to match door.
- I. Curtain Jamb Guides: Stainless steel or Aluminum with exposed finish matching curtain slats.
- J. Hood: Match curtain material and finish.
 1. Shape: Round or square per manufacturer's standard assembly.
 2. Mounting: Face of wall.
- K. Locking Devices: Equip door with locking device assembly and chain lock keeper.
 1. Locking Device Assembly: Cremona-type, both jamb sides locking bars, operable from inside with thumbturn and outside with cylinder.

L. Electric Door Operator:

1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower.
4. Motor Exposure: Interior and damp.
5. Motor Electrical Characteristics:
 - a. Horsepower: As required to meet performance requirements and provide functional features, but not less than 1/2 hp.
 - b. Voltage: 115 V ac, single phase, 60 Hz.
6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar; self-monitoring type.
 - a. Sensor Edge Bulb Color: Black.
8. Control Station(s): Interior mounted.
9. Other Equipment: Audible and visual signals and portable radio-control system .

M. Door Finish:

1. Powder-Coated Finish: Color matching Architect's sample, equal to an RAL non-metallic powercoat to match gray color to be selected for adjacent fiberglass door specified in section 081613.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face or provide manufacturer's standard color for interior curtain-slat.

2.04 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B209 (ASTM B209M) sheet or ASTM B221 (ASTM B221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm); and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.

3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum aluminum thickness of 0.032 inch (0.80 mm).
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.06 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B209 (ASTM B209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

2.07 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: As specified in Section 087100 "Door Hardware" and keyed to building keying system.
 2. Keys: Two for each cylinder.
- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.08 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.

2.09 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a

spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.010 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 - F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
 - G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
 - H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).
 - I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 - J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
 - K. Portable Radio-Control System: Consisting of the following per door operator:
 - 1. Three-channel universal coaxial receiver to open, close, and stop door.
 - 2. Two portable control devices to open and stop door may be momentary-contact type; control to close door is to be sustained- or constant-pressure type.
- 2.011 GENERAL FINISH REQUIREMENTS
- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
 - 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.

2.012 ALUMINUM FINISHES

- A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.013 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Doors: Install according to UL 325.

3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.02 PREINSTALLATION MEETINGS

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

1.03 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 aluminum-framed entrances and 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 type of 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.

4. Include point-to-point wiring diagrams showing the following:

- a. Power requirements for each electrically operated door hardware.
- b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. 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.

- E. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Certificates:

- 1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Test and Evaluation Reports:

- 1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by qualified testing agency or performed by the manufacturer and witnessed by a qualified testing agency.

C. Source Quality-Control Submittals:

- 1. Source quality-control reports.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

E. Qualification Statements:

- 1. For Installer.

F. Delegated design engineer qualifications.

G. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.06 QUALITY ASSURANCE

A. Qualifications:

- 1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in the State of Indiana and who is experienced in providing engineering services of the type indicated.
- B. 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.
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.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - 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

2.01 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without 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, 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: Specific component design wind pressures shall be calculated by supplier's engineer based on Design Loads for Structural Frame and Design Wind Load Criteria for Cladding and Cladding Backup, as provided in Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m).
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and 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. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

- G. Water Penetration under Dynamic Pressure: Test in accordance with 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 6.24 lbf/sq. ft. (300 Pa).
- H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.80 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.25 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa) when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.03 STOREFRONT SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the follow products from Kawneer North America; an Alcoa company or listed products by one of the Alternate Manufacturers:
- B. Thermally Broken Storefront Framing System: Trifab 601UT (2-inch x 6 inch) Thermal Center Set, Shear Block, Framing System.
1. Thermally Broken Entrance Doors: 500T Insulpour 500T Thermal Entrance Doors (2 1/4 inch) and applied stops on frames as indicated in drawings.
- C. Alternate Manufacturers
1. Cross Aluminum Products

- a. Thermally Broken Storefront Framing System: T-14650 Thermally Broken Series (2-inch x 6-1/2 inch) Framing System.
 - b. Thermally Broken Entrance Doors: WST-500-DG Thermal Entrances (2 inch) and applied stops on frames as indicated in drawings.
2. EFCO Corporation.
- a. Thermally Broken Storefront Framing System: X Therm Series 406X (2-inch x 6 1/2 inch) Thermal, Shear Block, Storefront Framing.
 - b. Thermally Broken Entrance Doors: Series D502 ThermaStile exterior entrance doors (2 inch) and applied stops as indicated in drawings.
3. Oldcastle Building Envelope™.
- a. Thermally Broken Storefront Framing System: Series 6000 XT (2-inch x 6 inch), Center Set Thermal Storefront Shear Block Framing System.
 - b. Thermally Broken Entrance Doors: WS-500TC Thermal Composite Entrance Doors (2-1/4 inch) and applied stops as indicated in drawings.
4. Tubelite Incorporated.
- a. Thermally Broken Storefront Framing System: TU24650 Series (2-inch x 6 1/2 inch), Thermal Storefront Center Set, Shear Block, Framing System as indicated in drawings.
 - b. Thermally Broken Entrance Doors: Therml = Block Wide Stile Entrance Doors (1-3/4 inch) and applied stops as indicated in drawings.
5. YKK AP America Inc.
- a. Thermally Broken Storefront Framing System: YES 60XT Thermal Storefront System, Shear Block, Storefront Framing System.
 - b. Thermally Broken Entrance Doors: MegaTherm 50XT exterior entrance doors and applied stops as indicated in drawings.
- D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Framing Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
 4. Fabrication Method: Field-fabricated stick system.
 5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 6. Steel Reinforcement: As required by manufacturer.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.04 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Door Construction: 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.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: As indicated, with wide stiles; 5-inch (127-mm) nominal width.
 - 3. Glazing Stops and Gaskets: Beveled or square per manufacturer's detail for door series listed, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 4. Finish: Match adjacent storefront framing finish.

2.05 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion.
 - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing. Fix weather strip in edge of doors with screw at top of strip.
- D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.06 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.07 MATERIALS

- A. Sheet and Plate: ASTM B209 (ASTM B209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.08 ACCESSORIES

- A. Automatic Door Operators: Section 087113 "Power Door Operators."
- B. 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, fabricated from 300 series stainless steel.
- C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- F. Rigid PVC filler.

2.09 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 that 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. Provisions for field replacement of glazing from interior.
 - 6. 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. Storefront Framing: Fabricate components for assembly using shear-block system.
 - 1. Provide head--receptor system to accommodate structural deflection where indicated in Drawings..
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. 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.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.010 ALUMINUM FINISHES

- A. Welcome Center Clearstory Windows, Welcome Center Room 114 Borrowed Lite, Trucker Restroom Frames and Doors: High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: Match Architect's sample, equal to PPG Duranar "Bone White" UC43350.

- B. Welcome Center Vestibule Doors and Frames, Storage Building Window Frames: Mica fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: Match Architect's sample, custom spray finish to provide color and gloss equal to custom coil coat sample, PPG BN8A1156 PPG Duranar Sunstorm, Ultra Cool, "Clear Creek Gray Metallic". This is a custom color.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.03 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.04 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.05 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.06 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
1. 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 entrance door hardware.

END OF SECTION 084113

SECTION 084426 – DICHROIC GLASS FACADE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes two proprietary glass support systems and two proprietary laminated dichroic glass manufacturer's which together provide two complete, yet unique, system options. The system components include, but are not limited to the following:

1. Laminated dichroic glass panels.
2. Finishing exposed glass edges.
3. Structural engineering of dichroic glass thickness, and glass supporting system.
4. Structural extruded aluminum support angles.
5. Secondary support angles, clips, or routels to support glazing from aluminum support angles.
6. Coordination of support angle locations with supporting structure design provided by design engineer for cold-formed metal framing.
7. Coordination of support angle installation with installation of sheathing, fluid-applied air barrier, water-drainage exterior insulation and finish system and its sealants.
8. Completion of dichroic glass installation.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for studs and headers supporting dichroic glass facade.
2. Section 072419 "Water-Drainage Exterior Insulation and Finish System" for wall finish and cementitious backer unit substrate behind dichroic glass facade.
3. Section 079100 "Joint Sealants" for sealants between wall finish and dichroic glass façade support angles.

1.02 DEFINITION

A. Glass Thickness: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site following receipt of approved shop drawings and product literature.

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.
3. Review proposed means to access supporting wall.
4. Verify schedule for completion of adjacent work. Identify adjacent work that presents risk of damage to dichroic glass panels once panels are installed. Determine necessary schedule adjustments to avoid damage.
5. Verify location of in place mock-up and number of typical panels mock-up is to include.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dichroic glass facade. Show fabrication and installation details. Include the following:
 - 1. Size and location of penetrations of wall finish system by support angles.
 - 2. Glass support method.
 - 3. Mounting method and accommodation of each angle of glazing and glazing support type.
 - 4. Attachments to other work.
 - 5. Full-size details of edge-finished profiles.
- C. Glass Samples: For the following products, 12 inches (300 mm) square:
 - 1. Each type of dichroic glass panel.
- D. Glazing Support Samples: Provide samples of final design components proposed to support dichroic glass panels. Samples will be returned following acceptance of the in-place mockup where requested by Contractor.
- E. Dichroic Glass Schedule: Drawings indicate dichroic glazing location and panel size. Provide drawing and schedule indicating proposed distribution of available dichroic glass panel color types across facade.
- F. Delegated Design Submittal: For decorative 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For dichroic glass confirming assembly conforms with safety glazing requirements.
- C. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of dichroic glass panel and supporting member to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups in the location and of the size as directed by Architect through review of shop drawings and discussion with fabricator.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect dichroic glass facade materials according to manufacturer's written instructions. Prevent damage to materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Retain packaging and sequencing numbers for decorative glass units.

1.09 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with dichroic glass facade by field measurements before fabrication.

1.010 WARRANTY

- A. 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Bendheim, LTD.; Glazing support system.
 - a. Bendheim, LTD.; Laminated glazing.
 2. Linel – a Division of Mestek, Inc.; Glazing support system.
 - a. Pulp Studio; Laminated glazing.
- B. Source Limitations for Glass: Obtain each type of dichroic glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain glazing support system from single source from single manufacturer, for each product and installation method.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design decorative glass.
- C. Structural Performance: Dichroic glass façade panels and supports shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Basic Wind Speed: 115 mph (51 m/s).
 - b. Exposure Category: B.
 - 2. Design Snow Loads: 20 psf minimum.
 - 3. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - a. 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 (25 mm), whichever is less.
- D. Safety Glazing: Where glazing is located adjacent to a walking surface and less than 42 inches above that surface, provide glazing that complies with 16 CFR 1201, Category II.

2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with glass product manufacturers' written instructions, NGA's "Laminated Glazing Reference Manual," and NGA's "GANA Glazing Manual" unless more stringent requirements are indicated or required by laminated film manufacturer. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- B. Safety Glazing Labeling: Where safety glazing is required, provide a certified affidavit stating that each glass unit complies with 16 CFR 1201, Category II.

2.04 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Heat-Strengthened Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

- D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

2.05 HARDWARE FOR GLASS INSTALLATION

- A. Glazing support system: Manufacturer's proprietary assembly of aluminum extrusions, connectors, and fasteners.

1. Bendheim System: Edge grips connected to support angle assembly.
2. Linel System: Routels connected to support angle assembly.
3. Materials:
 - a. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy as determined by manufacture necessary to meet structural performance requirements.
 - 1) Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 2) Color and Gloss:
 - a) Support Angles Embedded in Finish: Match Architect's sample, to match color of finish selected in section 072419 "Water-Drainage Exterior Insulation and Finish System. Basis-of-Design, equal to RAL color 9003 "Signal White".
 - b) Extruded Aluminum Clips: Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - b. Stainless steel bars and shapes: ASTM A276/A276M, Type 304 or Type 316.
 - c. Stainless steel castings: ASTM A743/A743M, Type 304 or Type 316.
 - 1) Stainless steel finish: Satin, No. 4.
4. Glazing Support System Fasteners: Stainless steel bolts and nuts. Bolts to be round head, torx or hex drive, annealed stainless steel bolts, ASTM F593 (ISO 3506-1); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1) or Group 2 (A4).
 - 1) Finish: Passivated
5. Support System to Cold-Formed Metal Framing Fasteners: Corrosion Resistant Steel Flat Head Drilling Screws for joining aluminum to steel framing.

- B. Gaskets: Manufacturer's standard, compatible with glass type and thickness.

2.06 LAMINATED DICHROIC GLASS FABRICATION

- A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

- B. Assemble interlayers and dichroic film to assure interlayers envelop and protect dichroic film and blocking moisture penetration between glass panels.
- C. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.
 - 1. Finished Edge: Flat polished square edges with slight kerfs.
- D. Lite Treatment: As required to provide complete assembly for connections selected.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of water-drainage exterior insulation and finish system, visit site and verify locations of cold-formed framing headers, blocking and other supporting members are within tolerances required for installation of the aluminum support angles.
 - 1. Photograph and identify locations of missing, mis-located, or incorrectly installed support framing. Prepare and share report of unacceptable conditions with Architect and Contractor. Contractor shall not proceed with installation of the water-drainage exterior insulation and finish system until corrections have been made and documented.
- B. Prior to installation of dichroic panel retention system, examine support angle installation , with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Finish system installation is complete and perimeter conditions are properly terminated and sealed.
 - 4. Sealant is complete between support angles and finish system.
 - 5. Base trim is complete and sealed to finish system.
- C. Prepare and share report of unacceptable conditions with Architect and Contractor. Contractor shall not proceed with installation of the dichroic façade until after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean members receiving dichroic glass immediately before installation. Remove coatings not firmly bonded to substrates. Verify gaskets, spacers and other glass protecting components are properly seated and ready to receive panels.
- B. Examine dichroic panels to locate orientation of outer surfaces and that the panel type is as indicated on the approved Shop Drawings. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 INSTALLATION

- A. Set dichroic panels in each series true to lines indicated in Drawings, with uniform orientation, pattern, draw, bow, and similar characteristics.
- B. Set dichroic panels with proper orientation so that each outer surface faces away from the finished face of wall.
- C. Set dichroic panels in locations indicated on approved Shop Drawings. Install glass with hardware and accessories according to manufacturer's written instructions. Attach hardware securely to mounting angles.

3.04 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of dichroic panels, hardware, hardware gaskets, and other system materials, unless more stringent requirements are indicated in referenced glazing publications.
- B. Protect dichroic panel 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.
- C. Do not exceed edge pressures stipulated by dichroic panel fabricator for installing panels.

3.05 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect panels from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces 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.

3.06 DICHROIC PANEL SCHEDULE

- A. Bendheim Dichroic Panels: Clear, laminated glass on each side of proprietary assembly of bonding interlayers and dichroic film.
 - 1. Glass Thickness: As required to meet performance requirements specified, but not less than 6 mm each.
 - 2. Dichroic Color: Three dichroic film types, distributed across façade in equal amounts, and as indicated in final, approved shop drawings and reviewed in approved mock-up.
 - 3. Provide Safety glazing where required.
- B. Pulp Studio Dichroic Panels: Clear, laminated glass on each side of proprietary assembly of bonding interlayers and dichroic film.

1. Glass Thickness: As required to meet performance requirements specified, but not less than 6 mm each.
2. Dichroic Color: Two dichroic film types, distributed across façade in equal amounts, and as indicated in final, approved shop drawings and reviewed in approved mock-up.
3. Provide Safety glazing where required.

END OF SECTION 088113

SECTION 086337 – EDGE CLAMPED FLUSH-GLAZED CURTAIN WALLS AND SKYLIGHTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Design, fabrication and erection of the flush-glazed glass and metal skin system (FGGMS) for vertical glazing, sloped glazing, inverted glazing and skylights.
2. Finish system for metal components of FGGMS.
3. Primary and secondary flashings required to tie FGGMS to adjacent fluid-applied membrane air-barrier, membrane roofing, metal panel and sealant systems.
4. Glass and glazing utilized in FGGMS.
5. Primary and secondary structural and weatherseal sealants for glazing system.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for structural steel framing supporting FGGMS system.
2. Section 079200 "Joint Sealants" for installation of joint sealants installed adjacent to FGGMS and for sealants to the extent not specified in this Section.
3. Section 084113 "Aluminum-Framed Entrances and Storefronts" for conventionally glazed storefront framing.
4. Section 088000 "Glazing" for performance requirements, glazing types, and coatings specified for glass and glazing incorporated into FGGMS system.

1.03 PREINSTALLATION MEETINGS

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

1.04 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 FFGMS. 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 type of vertical-to-horizontal intersection of FGGMS, 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 fluid-applied membrane air-barrier, membrane roofing and metal panel systems.
- C. Samples for Verification: 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 (300-mm) 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 FGGMS, including analysis data signed and sealed by a professional engineer licensed in the State of Indiana and responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
1. For Installer.
 2. For professional engineer's experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the State of Indiana.
- B. Product Test Reports: For FGGMS, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.
- C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.
- D. Source quality-control reports.
- E. Sample Warranties: For special warranties.

1.06 CLOSEOUT SUBMITTALS

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

- B. Maintenance Data for Structural Sealant: For FGGMS to include in maintenance manuals. Include ASTM C1401 recommendations for post installation-phase quality-control program.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. 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.
 - 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.
- C. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain-wall and skylight assemblies.

1.08 MOCKUPS

- A. 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 vertical glazing area, 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.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of FGGMS 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. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design FGGS curtain walls and skylights.
- B. General Performance: Comply with performance requirements specified, as determined by testing of FGGS representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Systems shall withstand movements of supporting structure, including, but not limited to 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.
- C. Structural Loads:
 1. Wind Loads: Specific component design wind pressures shall be calculated by supplier's engineer based on Design Loads for Structural Frame and Design Wind Load Criteria for Cladding and Cladding Backup, as provided in Drawings.
 2. Other Design Loads: As indicated on Drawings and specified in section 088000 – Glazing.
- D. Deflection of Framing Members: At design loads, as follows:
 1. Deflection Normal to the Plane of Glass: When subjected to a uniform load test in accordance with ASTM E330 by loads, limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans of greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing or panel bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing, panel or other fixed components to less than 1/8 inch (3.2 mm) or impair the function of, or damage, any joint seals.
- E. Structural: Test according to ASTM E330/E330M 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. Water Penetration under Static Pressure: Test according to ASTM E331 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 6.24 lbf/sq. ft. (300 Pa).
- G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K) as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined according to NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.3 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested according to ASTM E283.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 60 at 20% relative humidity with no condensation as determined according to AAMA 1502.7.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Structural-Sealant :
1. Designed to carry gravity loads of glazing.
- J. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by FGGS 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.

2.02 SOURCE LIMITATIONS

- A. Obtain all components of FGGMS, including framing and accessories, from single manufacturer.

2.03 EDGE CLAMPED FLUSH-GLAZED CURTAIN WALLS AND SKYLIGHTS

- A. Manufacturers: Subject to compliance with requirements, provide the following:
 1. Linel – a Division of Mestek, Inc.; SG2000 Flush Glazed Skin System.
- B. Framing Members: Skin type, supported by structural-steel framing. Provide manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Fabrication Method: Factory-fabricated glazing system and framing components for field assembly and field-installed weather sealant joints.
 2. Glazing System: Glazing retained by extruded aluminum clips that engage with glazing channel, Channel adhered to glazing panel with structural sealant on four sides of panel.
 3. Skylight Glazing Framing Members: Designed to provide internal gutter system to collect and channel water from infiltration or condensation back to the exterior.
 4. Glazing Framing Support: Glazing framing connects to structural steel frame with continuous support channels that permit vertical adjustment and alignment of frame members over structure.
 5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 6. Finish: High-performance organic finish.
 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 8. Steel Reinforcement: As required by manufacturer.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.04 GLAZING

- A. Comply with Section 088000 "Glazing."
- B. Glazing Gaskets:
 1. ASTM C509 or ASTM C864. Manufacturer's standard.
 - a. Color: Black.
- C. Glazing Interior Component Sealants:
 1. As recommended by manufacturer.

a. Color: White

- D. Structural Glazing Sealants, Vertical Glazing: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in structural-sealant-glazed curtain-wall assembly indicated.
 - 1. Color: Gray.
- E. Structural-Sealant Glazing, Skylight, Sloped and Inverted Sloped Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed sloped glazing assemblies.
 - 1. Color: Gray.
- F. Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.
- G. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - 1. Color: Color to be selected by Architect from Manufacturer's full range of colors to harmonize with glazing and metal panels.

2.05 MATERIALS

- A. Sheet and Plate: ASTM B209 (ASTM B209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
- C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- D. Structural Profiles: ASTM B308/B308M.
- E. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- F. Steel Reinforcement Primer: 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.

2.06 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.
 - a. Fasteners in wet or potentially wet areas to be, fabricated from 300 series stainless steel.
- B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.07 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Shop fabricate framing members and their connections to the greatest extent possible.
1. 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.
 2. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Physical and thermal isolation of glazing from framing members.
 - d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - e. Provisions in skylight framing to provide continuous internal guttering to route condensation to the exterior once framing is assembled in field.
 3. Provide for field replacement of glazing from exterior.
 4. Provide insulated interior and exterior sheet metal panels at perimeter of system to provide complete weathertight system assembly and to provide details to complete seals to adjacent air barriers, roof system, metal panel systems, flashings and copings.
 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Factory-Assembled Glazing Units and Fabricated Frame Components:
1. 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.
 2. Install glazing retaining channels to glazing.
 - a. Set glazing onto retaining channels according to sealant manufacturer and framing manufacturer's written instructions and standard practice.
 - b. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity between channel and glass, according to sealant manufacturer's written instructions.
 - d. Set glazing to prevent undue stresses on the assembly until sealant is fully cured according to manufacturer's recommendations.

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

2.08 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss:
 - a. Interior Extruded Aluminum Components and Interior Face of Metal Panels Exposed to View: Match Architect's sample, equal to PPG Duranar UC43350 "Bone White".
 - b. Exterior Face of Metal Panels: Match Architect's sample, equal to RAL 7022 "Umbra Grey".

2.09 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Review supporting structural steel for alignment at joints and between members. Identify conditions detrimental to installation of flush-glazed systems or beyond system's integral adjustment allowances.
- C. Confirm air-barrier and roof flashing has been completed to perimeter of openings.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF EDGE CLAMPED FLUSH-GLAZED CURTAIN WALLS AND SKYLIGHTS

- A. General:
 - 1. Comply with manufacturer's written instructions and approved shop drawings.
 - 2. Do not install damaged components.
 - 3. Fit joints between framing members to produce hairline joints free of burrs and distortion.
 - 4. Install components plumb and true in alignment with established lines and supporting structural steel framing.

B. Installation of framing members.

1. Arrange and align frame receiving channels over structural steel framing. Connect channels to steel framing with threaded stud anchors welded to steel framing. Spacing and type to be indicated in approved shop drawings as selected by fabricator's design engineer.
2. Set and align system horizontals and rafters over channels and fasten system together.
3. Seal skylight framing horizontals to sloped rafters with silicone sealant to provide a complete, water-tight internal guttering system to the exterior.
4. Install gaskets into frame members, complete seals between members, clean metal shavings and cuttings from gutters, and otherwise prepare system to receive glazing and perimeter panels.

C. Installation of glazing.

1. Set glazing on gasketing so assembly is elevated as needed to protect insulated glass seals.
2. Align glazing with setting blocks, spacers, alignment chairs and support stops to meet specified tolerances in joint width and alignment between adjacent system elements.
3. Secure glazing to framing with extruded aluminum retention clips fastened to frame. Maintain clearance between metal components and edges of glazing necessary to accommodate thermal movement in glazing panels.
4. After verification of glazing alignment, insert backer rod between glazing and panel units recommended by sealant manufacturer.
5. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.
6. Clean and protect glass as indicated in Section 088000 "Glazing."

3.03 ERECTION TOLERANCES

A. Install FGGS to comply with the following maximum tolerances:

1. True to position: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
3. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

END OF SECTION 084423

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - b. ~~Sliding doors.~~
 - c. ~~Folding doors.~~
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Requirements:

1. ~~[Section 064113 "Wood Veneer Faced Architectural Cabinets"] [and] [Section 064116 "Plastic Laminate Faced Architectural Cabinets"] for cabinet door hardware provided with cabinets.~~
2. ~~Section 081113 "Hollow Metal Doors and Frames" [for astragals provided as part of labeled fire-rated assemblies] [and] [for door silencers provided as part of hollow metal frames].~~
3. ~~Section 081119 "Stainless Steel Doors and Frames" [for astragals provided as part of labeled fire-rated assemblies] [and] [for door silencers provided as part of stainless steel frames].~~
4. ~~Section 081173 "Sliding Metal Fire Doors" for door and track preparation, reinforcement, and motorized operators provided as part of automatic closing assemblies.~~
5. ~~Section 081213 "Hollow Metal Frames" [for astragals provided as part of labeled fire-rated assemblies] [and] [for door silencers provided as part of hollow metal frames].~~
6. ~~Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.~~
7. ~~Section 081316.13 "Aluminum Terrace Doors" for entrance door hardware, [except] [including] cylinders.~~
8. ~~Section 081416 "Flush Wood Doors" for [astragals] [and] [integral intumescent seals] provided as part of labeled fire-rated assemblies.~~
9. ~~Section 081433 "Stile and Rail Wood Doors" for [astragals] [and] [integral intumescent seals] provided as part of labeled fire-rated assemblies.~~

- ~~10.1.~~ Section 083113 "Access Doors and Frames" for access door hardware, ~~[except]~~ **[including]** cylinders.
- ~~11.2.~~ Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
- ~~12.~~ ~~Section 083326 "Overhead Coiling Grilles" for door hardware provided as part of overhead coiling grille assemblies.~~
- ~~13.~~ ~~Section 083463 "Detention Doors and Frames" for door silencers provided as part of detention frames.~~
- ~~14.~~ ~~[Section 083473.13 "Metal Sound Control Door Assemblies"] [and] [Section 083473.16 "Wood Sound Control Door Assemblies"] for hinges and gasketing provided as part of sound-rated door assemblies.~~
- ~~15.~~ ~~Section 083513 "Folding Doors" for pulls, latches, hinges, guides, and pivots provided as part of the folding door package.~~
- ~~16.3.~~ Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, **[except]** **[including]** cylinders and gasketing not specified in this section.
- ~~17.~~ ~~Section 084126 "All Glass Entrances and Storefronts" for entrance door hardware, [except] [including] cylinders.~~
- ~~18.~~ ~~Section 084229.13 "Folding Automatic Entrances" for entrance door hardware, [except] [including] cylinders.~~
- ~~19.~~ ~~Section 084229.23 "Sliding Automatic Entrances" for entrance door hardware, [except] [including] cylinders.~~
- ~~20.~~ ~~Section 084229.33 "Swinging Automatic Entrances" for entrance door hardware, [except] [including] cylinders.~~
- ~~21.~~ ~~Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for entrance door hardware, [except] [including] cylinders.~~
- ~~22.4.~~ Section 087113 "Automatic Door Operators" for low-energy power operators and low-energy power-assist operators.
- ~~23.~~ ~~Section 087163 "Detention Door Hardware" for hardware for detention doors.~~
- ~~24.~~ ~~Section 102213 "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, [except] [including] cylinders.~~
- ~~25.~~ ~~Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.~~
- ~~26.~~ ~~Section 133419 "Metal Building Systems" for door hardware, [except] [including] cylinders.~~
- ~~27.~~ ~~Section 134900 "Radiation Protection" for lead-lined astragals provided as part of labeled fire-rated assemblies.~~
- ~~28.~~ ~~Section 281300 "Access Control" for access control devices installed at door openings and provided as part of a security system.~~
- ~~29.~~ ~~Section 281600 "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion detection system.~~
- ~~30.~~ ~~Section 283111 "Digital, Addressable Fire Alarm System" for connections to building fire alarm system.~~
- ~~31.~~ ~~Section 283112 "Zoned (DC Loop) Fire Alarm System" for connections to building fire alarm system.~~

~~1.03~~ ALLOWANCES

~~Retain products and Work included in this Section that are covered by cash or quantity allowance. Do not include amounts. Insert descriptions of items in Part 2 or 3 to provide information affecting the cost of the Work that is not included under the allowance.~~

- ~~A.~~ ~~Door hardware is part of [Door Hardware Allowance] <Insert allowance>.~~

~~1.04~~1.03 COORDINATION

~~A. Floor Recessed Door Hardware: Coordinate layout and installation with floor construction.~~

~~1. Cast anchoring inserts into concrete.~~

~~B.A.~~ Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

~~C.B.~~ Security: Coordinate installation of door hardware, keying, and access control [with Owner's security consultant].

~~D.C.~~ Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

~~E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.~~

~~1.05~~1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] ~~<Insert location>~~.

1. Conference participants shall include Owner, Architect, Contractor, Access Control Subcontractor, Installer's Architectural Hardware Consultant, and Owner's security consultant.
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Owner ~~and~~; Installer's Architectural Hardware Consultant ~~and Owner's security consultant~~.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

~~1.06~~ 1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

~~Retain "Shop Drawings" Paragraph below for electrified door hardware.~~

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.
3. Schematic diagram of systems that interface with electrified door hardware.
 - a. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
4. Elevations of doors controlled by electrified door hardware.

~~C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.~~

- ~~1. Tag Samples with full product description to coordinate Samples with door hardware schedule.~~

~~D. Samples for Initial Selection: For each type of exposed finish.~~

~~E. Samples for Verification: For each type of exposed product, in each finish specified.~~

- ~~1. Sample Size: Full size units or minimum 2 by 4 inch (51 by 102 mm) Samples for sheet and 4 inch (102 mm) long Samples for other products.
 - a. Full size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.~~
- ~~2. Tag Samples with full product description to coordinate Samples with door hardware schedule.~~

~~F.C.~~ F.C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - a. Number and date each page of schedule.
 - b. Double space content to allow for reviewer comments.

3. Content: Include the following information:
 - a. Identification number, location, hand, ~~fire rating~~, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.

~~G.D.~~ Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

~~1.07~~ 1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For ~~{~~Installer~~}~~ ~~{and}~~ ~~{~~Architectural Hardware Consultant~~}~~.
- B. Product Certificates: For each type of electrified door hardware.
 1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

~~1.08~~ 1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final ~~{~~door hardware~~}~~ ~~{and}~~ ~~{~~keying~~}~~ schedule.

~~1.09~~ ~~MAINTENANCE MATERIAL SUBMITTALS~~

~~See "Maintenance Materials" Article in the Evaluations for discussion of extra materials.~~

- ~~A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.~~

- ~~1. Door Hardware: <Insert detailed descriptions and specific numbers of units>.~~
- ~~2. Electrical Parts: <Insert detailed descriptions and specific numbers of units>.~~

~~1.010~~1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an ~~Architectural Hardware Consultant (AHC)~~ {Architectural Hardware Consultant (AHC) or an Electrified Hardware Consultant (EHC)} or {Architectural Openings Consultant (AOC)}.

~~1.011~~1.09 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- ~~C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.~~
- ~~D.C.~~ D.C. Deliver keys{ and permanent cores} to Owner by registered mail or overnight package service.

~~1.012~~1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Period: {Three} ~~<Insert number>~~ years from date of Substantial Completion unless otherwise indicated below:

- a. ~~[Electromagnetic] [and] [Delayed Egress] Locks: [Five] <Insert number> years from date of Substantial Completion.~~
- b.a. Exit Devices: Two <Insert number> Three years from date of Substantial Completion.
- e.b. Manual Closers: 10 <Insert number> years from date of Substantial Completion.
- d. ~~Concealed Floor Closers: [Five] [10] [25] <Insert number> years from date of Substantial Completion.~~

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. ~~Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.~~

2.02 PERFORMANCE REQUIREMENTS

- ~~A. Fire Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.~~
- ~~B. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - ~~1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3 inch wg (75 Pa) of water.~~~~
- C.A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- ~~D.B.~~ Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- ~~E.C.~~ Accessibility Requirements: For door hardware on doors in an accessible route, comply with ~~[the DOJ's "2010 ADA Standards for Accessible Design"] [the DOT's "ADA Standards for Transportation Facilities"] [the ABA standards of the Federal agency having jurisdiction] [ICC A117.1] [HUD's "Fair Housing Accessibility Guidelines"] [and] <Insert regulation>~~ the Indiana Building Code.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - 2. Comply with the following maximum opening-force requirements:

- a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - ~~c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.~~
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
 - ~~5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.~~

2.03 SCHEDULED DOOR HARDWARE

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 1. Door hardware is scheduled in Part 3 "Door Hardware Schedule" at the end of this section.
- B. Door Hardware Sets: Provide quantity, item, size, ~~finish~~finish, or color indicated, and Basis-of-Design Products or products equivalent in function and comparable in quality to Basis-of-Design products from listed alternate manufacturers.
- C. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- D. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated by Basis-of-Design Products and technical requirements in Part 2, as well as additional information in Part 3 "Door Hardware Schedule" Article.
 1. Basis-of-Design Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements for design, type, quality and function. Refer to Section 016000 Product Requirements. Where only the manufacturer is listed as the Basis-of-Design, specific product references are provided in Part 3 "Door Hardware Schedule" Article.
 2. References to BHMA Designations: Indicated to establish minimum requirements for quality, and function.

2.04 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Hager Companies; 1191, 1279, BB1191, BB1279, BB1199 or a comparable product by one of the following manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional requirements.
 - a. Allegion plc.

- b. Bommer Industries, Inc.
 - c. Lawrence Hardware Inc.
 - d. McKinney Products Company; an ASSA ABLOY Group company.
 - e. PBB, Inc.
 - f. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Size: 4-1/2 by 4-1/2 unless noted otherwise in Part 3 "Door Hardware Schedule" Article.
 3. Quantity: Provide the following unless otherwise indicated:
 - ~~a. Two Hinges: For doors with heights up to 60 inches (1524 mm).~~
 - b.a. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
 - ~~e. Four Hinges: For doors with heights 91-120 inches (2311 to 3048 mm).~~
 - ~~d. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).~~
 4. Hinge Weight: Unless otherwise indicated, provide the following:
 - a. Entrance Doors: Heavy-weight ball-bearing hinges.
 - b. Doors with Closers: Five Knuckle ball-bearing hinges.
 - c. Interior Doors: Standard-weight hinges.
 5. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - ~~a. Exterior Hinges: Stainless steel with stainless steel pin body and heads.~~
 - b.a. Interior Hinges: Brass with stainless-steel pin body and brass protruding heads.
 - ~~e. Hinges for Fire-Rated Assemblies: Steel, with steel pin.~~
 6. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - ~~1) Outswinging exterior doors.~~
 - 2)1) Outswinging corridor doors with locks.
 - b. Corners: Square.
 7. Electrified Hinges: Standard-weight ball-bearing hinges.
 - a. Conceal conductors in hinge body.
 - b. Provide 10 continuous electrical conductors.
 - c. Locate electrified hinges at center hinge location.
 - ~~8. Swing Clear Hinges: Reversible, standard-weight ball-bearing hinges.~~
 - 9.8. Fasteners: Comply with the following:

- a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
- b. Wood Screws: For wood doors.
- c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
- d. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

2.05 SELF-CLOSING HINGES ~~AND PIVOTS~~

A. Self-Closing Hinges ~~and Pivots~~: BHMA A156.17.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PBB LE51 Cam Lift Mortise Hinge or a comparable product by one of the following manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional requirements.

a. American Builders Hardware Manufacturing; A950.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2.06 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: BHMA A156.4.

~~1. Center Hung Pivot Basis-of-Design Product: Subject to compliance with requirements, provide Rixson Specialty Door Controls; an ASSA ABLOY Group company; Model 370 top and bottom pivot set; or a comparable product by one of the following:~~

- ~~a. Allegion plc.~~
- ~~b. DORMA USA, Inc.~~
- ~~c. Hager Companies.~~

2.1. Offset Pivot Basis-of-Design Product: Subject to compliance with requirements, provide Rixson Specialty Door Controls; an ASSA ABLOY Group company; Model 195 top and bottom pivot set with M19 intermediate pivot; or a comparable product by one of the following:

- a. Allegion plc.
- b. DORMA USA, Inc.
- c. Hager Companies.

2.07 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

~~B. Pin and Barrel Type Hinges:~~

~~1. Basis-of-Design Product: Subject to compliance with requirements, provide Hager Companies ; Series 790-900 stainless steel hinge or a comparable product by one of the following:~~

- ~~a. Allegion plc.~~
- ~~b. Lawrence Hardware Inc.~~
- ~~c. McKinney Products Company; an ASSA ABLOY Group company.~~
- ~~d. Stanley Commercial Hardware; a division of Stanley Security Solutions.~~

~~C.B.~~ Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hager Companies ; Series 780 series, or a comparable product by one of the following manufacturers. Refer to Part 3 "Door Hardware Schedule" Article for additional product design requirements.
 - a. Allegion plc.
 - b. Bommer Industries, Inc.
 - c. McKinney Products Company; an ASSA ABLOY Group company.
 - d. Stanley Commercial Hardware; a division of Stanley Security Solutions.
 - e. Select Hinges.
 - f. Zero International, Inc.

2.08 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts ~~required for labeled fire doors,~~ and as follows:
 - ~~1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.~~
 - ~~2.1.~~ Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - ~~3.2.~~ Deadbolts: Minimum {1-inch (25-mm)} ~~{1.25-inch (32-mm)}~~ ~~<Insert dimension>~~ bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
 1. Description: As indicated by manufacturer's model designation in Basis of Design definitions.
 2. Levers: {Wrought}, {Forged} or {Cast}.
 - ~~a. <Insert model number and description>.~~
 3. Escutcheons (Roses): {Wrought} or {Forged} {Cast}.
 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 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 trim or where required by door inset on aluminum framing.

3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

~~F. Bored Locks: BHMA A156.2; [Grade 1] [Grade 2]; Series 4000.~~

- ~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage Commercial ND Series lock with "Athens" lever and escutcheon or a comparable product by one of the following:~~

- ~~a. Best Access Systems; Stanley Security Solutions, Inc. (93K 7 14D)~~
- ~~b. Corbin Russwin, Inc.; an ASSA ABLOY Group company (CL3500, PZD "Armstrong").~~

- ~~2. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~G.F. Mortise Locks: BHMA A156.13; [Operational Grade 1] [Security Grade 1] [Operational Grade 2] [Security Grade 2]; stamped steel case with steel or brass parts; Series 1000.~~

- ~~1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Commercial Lock Division, L9000 series, Lever 03, or a comparable product by one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.:~~

- ~~a. Best Access Systems; Stanley Security Solutions, Inc. (45H, Lever 3, Rose H)~~

~~a. Allegion; Schlage (L9000, Lever 03, Rose B)~~

- ~~1) Doors with Special Privacy Function in Hardware Schedule; L9496 with sectional indicator on outside of door with "Vacant/Occupied" text (L283-722).~~
- ~~2) Doors with Electrified Lockset in Hardware Schedule; L9092EU.~~

~~b. Corbin Russwin, Inc.; an ASSA ABLOY Group company. (ML 2000, LWA)~~

- ~~1) Doors with Special Privacy Function in Hardware Schedule; ML2065 with ML190 sectional indicator on outside of door with "Vacant/Occupied" text (V50).~~
- ~~2-2) Doors with Electrified Lockset in Hardware Schedule; ML20606~~

~~H. Interconnected Locks: BHMA A156.12; [Grade 1] [Grade 2]; Series 5000.~~

- ~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~I. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.~~

- ~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Ives L30 or a comparable product by one of the following:~~

- ~~a. Architectural Builders Hardware Mfg., Inc. (1891)~~
- ~~b. Don Jo Mfg., Inc. (1700)~~
- ~~c. Door Controls International, Inc. (4030)~~

~~J. Push Pull Latches: [Bored, BHMA A156.2; Series 4000] [Mortise, BHMA A156.13]; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.~~

- ~~a. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Glynn Johnson HL 6 or a comparable product by one of the following:~~
 - ~~b. Architectural Builders Hardware Mfg., Inc. (Q6800 Series)~~
 - ~~2. Rockwood Manufacturing Company; an ASSA ABLOY Group company. (596 Series)~~
 - ~~3. Grade: [1] [2].~~

2.09 AUXILIARY LOCKS

- A. ~~Bored~~Surface Mounted Auxiliary Locks: Sliding stainless steel bolt released by standard mortise cylinder to lock door. Solid aluminum case. Through bolt mounting. BHMA A156.36: [Grade 1] [Grade 2]; with strike that suits frame.
 - ~~a.1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage B600 Series or a comparable product by one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.~~Progressive Hardware Co., Inc R1000 Drop Bolt Lock with cylinder specified in this specification section.
 - ~~b. Best Access Systems; Stanley Security Solutions, Inc. (8T Series Deadbolts).~~
 - ~~e. Corbin Russwin, Inc.; an ASSA ABLOY Group company (DL3000).~~
- B. ~~Mortise Auxiliary Locks: BHMA A156.36; [Grade 1] [Grade 2]; with strike that suits frame.~~
 - ~~a. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage L460 Series or a comparable product by one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.~~
 - ~~2. Best Access Systems; Stanley Security Solutions, Inc. (48 H series)~~
 - ~~a. Corbin Russwin, Inc.; an ASSA ABLOY Group company. (DL4100)~~
- C. ~~Narrow Stile Auxiliary Locks: BHMA A156.36; [Grade 1] [Grade 2]; with strike that suits frame.~~
 - ~~1. Basis of Design Product: Subject to compliance with requirements, provide Adams Rite Manufacturing Co; an ASSA ABLOY Group company; or a comparable product by one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.~~
 - ~~a. Accurate Lock & Hardware Co.~~
- D. ~~Push Button Combination Locks: BHMA A156.36; cylindrical; Grade 1; lock opens by entering a one to five digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.~~
 - ~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2.010 ELECTRIC STRIKES

- A. ~~Electric Strikes: BHMA A156.31; [Grade 1] [Grade 2]; with faceplate to suit lock and frame.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Von Duprin 6100 or 6200 Series Heavy Duty Electric Strike or a comparable product by one of the following manufactures. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.~~

- ~~a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.~~
- ~~b. HES, Inc.; an ASSA ABLOY Group company.~~
- ~~c. Security Door Controls.~~

~~2.011 ELECTROMAGNETIC LOCKS~~

~~A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full exterior or full interior type, as required by application indicated.~~

~~B. Delayed Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than three seconds initiates irreversible alarm and adjustable time delay for egress. When integrated with fire alarm, fire alarm voids time delay.~~

~~2.012 ELECTROMECHANICAL LOCKS~~

~~A. Electromechanical Locks: BHMA A156.25; [Grade 1] **Grade 2**; motor or solenoid driven; with strike that suits frame.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage AD series or a comparable product by one of the following:~~

- ~~a. Best Access Systems; Stanley Security Solutions, Inc. (40HM Series).~~
- ~~b. SARGENT Manufacturing Company; ASSA ABLOY. (Profile Series).~~

~~2. Type:: [**Bored**] [Mortise latchbolt] [**Mortise deadbolt**] [**Mortise deadlocking latchbolt**].~~

~~2.013 SELF-CONTAINED ELECTRONIC LOCKS~~

~~A. Self-Contained Electronic Locks: BHMA A156.25, [bored] **mortise**; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc dichromate plated, wrought steel case, and strike that suits frame. Provide key override, low battery detection and warning, LED status indicators, and ability to program at the lock.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage GO series or a comparable product by one of the following:~~

- ~~a. Best Access Systems; Stanley Security Solutions, Inc. (B.A.S.I.S. Series).~~
- ~~b. SARGENT Manufacturing Company; ASSA ABLOY. (Profile Series).~~

~~2.015 SURFACE BOLTS~~

~~A. Surface Bolts: BHMA A156.16.~~

~~2.016~~ — SURFACE CREMONE BOLTS

~~A. Heavy Duty, Oversize Door, Steel Cremone Bolts: Surface mounted assembly fabricated to door height. Bolts at top and bottom of door activated by lever on exterior and interior of door. Interior lever and bolts equipped with hasp style assembly to receive padlock. Padlock is not provided as part of assembly.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Richards-Wilcox, Inc. 1028 Heavy Duty Cremone Bolt or comparable product by the following:~~

~~a. —~~

~~2.017~~ 2.010 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; IVES FB 358 for wood or fiberglass doors; FB457 for metal doors, or a comparable product by one of the following:

- a. Burns Manufacturing Incorporated.
- b. Door Controls International, Inc.
- c. Hiawatha, Inc; a division of the Activar Construction Products Group.
- d. Trimco.

~~2.018~~ — AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

~~A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4 inch (19 mm) throw; designed for mortising into door edge. [Include wear plates.]~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Ives FB41 for wood doors, FB 31 for metal doors, or a comparable product by one of the following:~~

- ~~a. Burns Manufacturing Incorporated.~~
- ~~b. Cal Royal Products, Inc.~~
- ~~c. Door Controls International, Inc.~~
- ~~d. Trimco.~~

~~2.019~~ 2.011 DUSTPROOF STRIKES

A. Dustproof Strikes: BHMA A 156.16, Grade 1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives DP2; or comparable product by one of the following:

- a. Burns Manufacturing Incorporated.
- b. Door Controls International, Inc.
- c. Hiawatha, Inc.
- d. Trimco

~~2.020~~2.012 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Von Duprin, 98 Series with #697 Pull, #03 lever and cylinder dogging where noted in hardware sets or a comparable product by one of the following:
 - a. ~~Precision Hardware, Inc.; a Stanley company.~~

~~2.021~~2.013 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. ~~[Provide cylinder from same manufacturer of locking devices.]~~
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Best Access Systems; Stanley Security Solutions, Inc.
- ~~B. Standard Lock Cylinders: BHMA A156.5; [Grade 1] [Grade 1A] [Grade 2] permanent cores; face finished to match lockset.~~
 - ~~1. Core Type: [Interchangeable] [Removable].~~
- ~~E. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.~~
- F.C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

~~2.022~~2.014 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. ~~[Incorporate decisions made in keying conference.]~~
 - ~~5.1.~~ Existing System:
 - a. Review lock system with Owner and provide keyways and pins coordinated with master, grand master, great-grand master, etc. keying as necessary to integrate new locks into Owner's existing system.
 - ~~6.2.~~ Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver or Brass as selected by Owner.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following keys aligned with the key level determined by the final site key system:
 - a. Cylinder Change Keys: Three.
 - b. Master Keys: Five.
 - c. Grand Master Keys: Five.
 - d. Great-Grand Master Keys: Five.

~~2.023~~2.015 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Key Boxes and Cabinets.
 - b. GE Security, Inc.
 - c. HPC, Inc.
 - d. Lund Equipment Co., Inc.
 - e. MMF Industries.
 - f. TelKee; Oasis International.

~~2. Multiple Drawer Cabinet: [Grade 1] [Grade 2] cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.~~

~~3.2. Wall-Mounted Cabinet: [Grade 1] [Grade 2] cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.~~

~~B. Key Lock Boxes: Designed for storage of [two] [10] <Insert number> keys.~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~C. Key Control System Software: Multiple index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~2.024~~2.016 OPERATING TRIM

- A. Swinging Door Operating Trim: BHMA A156.6; brass, bronze, stainless steel, as noted by Basis-of-Design product or finish indicated in Part 3 "Door Hardware Schedule" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rockwood Manufacturing Company; an ASSA ABLOY Group company~~Hager Companies~~ product listed below or a comparable product by one of the Alternate Manufacturers:

- a. ~~Push: 80S (4 inch by 16 inch, 0.125 inch (3.2 mm) thickness).~~
- b. ~~Pull: 4J (10 inch CTC).~~

~~e. Cylinder Pull: 121L.~~

~~d.a. Building Entry Push: RM3341; 1 1/4" dia, 30 inch CTC at east vestibule, 36 inch CTC at west vestibule.~~

~~e.b. Building Entry Pull: RM3341, 1 1/4 inch diameter, 70 1/4 inch top to bottom bracket CTC, intermediate bracket located to not conflict with cylinder location. 71 1/2 inch overall length.~~

2. Alternate Manufacturers

~~a. Allegion plc.~~

~~a. Burns Manufacturing Incorporated. VP 4221~~

B. Sliding Door Operating Trim: BHMA A156.6; brass, bronze, stainless steel, as noted by Basis-of-Design product or finish indicated in Part 3 "Door Hardware Schedule" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Trimco 1110 Series Flush Pull, 1110-18 (18 inch by 2 1/2 inch).

~~b. _____~~

~~c. Hiawatha, Inc; a division of the Activar Construction Products Group.~~

~~d. Rockwood Manufacturing Company; an ASSA-ABLOY Group company.~~

~~e. Trimco.~~

~~2.025 ACCESSORIES FOR PAIRS OF DOORS~~

~~A. Bar Coordinators: BHMA A156.3, Grade 1; consisting of active leaf, hold open lever and inactive leaf release trigger; fabricated from steel with nylon-coated strike plates; with built in, adjustable safety release; and with internal override.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Ives COR series with FL filler sections or a comparable product by one of the following:~~

~~a. Architectural Builders Hardware Mfg., Inc.~~

~~b. Burns Manufacturing Incorporated.~~

~~c. Hager Companies.~~

~~d. Trimco.~~

~~B. Carry Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry open bars with strike plate for inactive leaves of pairs of doors unless automatic or self latching bolts are used.~~

~~C. Astragals: BHMA A156.22.~~

~~D. Removable Mullion: Steel assembly 2 inches (51 mm) wide by 3 inches (76 mm) deep with a wall thickness of 1/8 inch (3 mm). Mullion may be removed in a single operation of keyed mortise cylinder at the head of the mullion. Key cylinder to match building key system. Mullion to self-lock when re-installed in opening. Provide powder coat finish as selected by Architect.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Von Duprin KR4954; or comparable product by one of the following:~~

~~a. Precision Hardware, Inc.; Division of Stanley Security Solutions, Inc (822 series).~~

~~E. Two Point Latch Assembly: Steel assembly with lever and concealed vertical rods that latch at the top and bottom of the inactive leaf of a pair of doors. Lever located on secure side of door.~~

~~a. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc, Von Duprin 273L-BE with lever #03.~~

~~F. Open Back Strike: Cast or wrought metal strike, sized to fit into the edge of the inactive leaf of a pair of metal doors. Open back of strike allows inactive leaf to close prior to or after active leaf closes without the use of a coordinator.~~

~~a. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc, Von Duprin 576A.~~

~~2.026~~ 2.017 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with cast iron body, adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; LCN Closers, 4040 Series, or a comparable product by one of the following manufacturers. Provide accessories such as Spring Cush Arm (integral stop) or Hold Open Arm (hold open) where indicated in the "Door Hardware Schedule" in Part 3 of this section.

a. Norton Door Controls; an ASSA ABLOY Group company. (9500 series)

~~2.027~~ CONCEALED CLOSERS

~~A. Closer Concealed in Head of Frame, Offset Pivots and Hinges: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; LCN 2010 with track in head of door:~~

~~A. Closer Concealed in Floor, Glass Door, Center Pivots: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide DORMA Architectural Hardware; Member of The DORMA Group North America BTS 80 with track in head of door; or a comparable product by one of the following:~~

~~a. Rixson Specialty Door Controls; an ASSA ABLOY Group company.~~

~~2.028~~ — ~~CLOSER HOLDER RELEASE DEVICES~~

~~A. Closer Holder Release Devices for Rated Openings: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire or smoke detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system or loss of power.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; LCN 4410ME Series closer.~~

~~A. Closer Holder Release Devices for High Traffic Openings: BHMA A156.15; Grade 1; closer connected with separate or integral presence detecting scanner. Hold open function activated when door is opened to 80 degrees or more. Door shall become self-closing upon scanner sensing path of door swing is clear and delay timer releases hold open function. Built-in switch controls hold open function of closer from continuous to scanner controlled.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; LCN HSA Series closer.~~

~~2.029~~ 2.018 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives product listed below or a comparable product by one of the Alternate Manufacturers:

- a. Wall Stop: WS406CCV or WS407CCV.
- b. Floor Stop: FS 13.
- c. ~~Exterior Floor~~Vestibule Floor Stop: ~~FS444~~FS410.
- d. Exterior Wall Stop/Holder: ~~WS45~~WS20X.

2. Alternate Manufacturers:

- a. Architectural Builders Hardware Mfg., Inc.
- b. Burns Manufacturing Incorporated.
- ~~b.~~c. Emtek
- ~~c.~~d. Hager Companies.
- ~~d.~~e. Hiawatha, Inc.
- ~~e.~~f. Rockwood Manufacturing Company.
- ~~f.~~g. Stanley Commercial Hardware.
- ~~g.~~h. Trimco.

~~2.030~~ — ~~ELECTROMAGNETIC STOPS AND HOLDERS~~

~~A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; [wall mounted electromagnetic single] [floor mounted electromagnet single] [floor mounted electromagnet double] unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.~~

~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; LCN SEM 7840/50 recessed wall mount magnetic door holder or a comparable product by one of the following:~~

- ~~a. Architectural Builders Hardware Mfg., Inc.~~
- ~~b. DORMA USA, Inc.~~
- ~~c. Hager Companies.~~
- ~~d. SARGENT Manufacturing Company; ASSA ABLOY.~~

~~2.031 OVERHEAD STOPS AND HOLDERS~~

~~A. Concealed Overhead Stops and Holders: BHMA A156.8, Grade 1.~~

- ~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Glynn Johnson 100 series or a comparable product by one of the following manufacturers. Function and additional product design requirements are specified in the "Door Hardware Schedule" in Part 3 of this section.~~

- ~~a. Architectural Builders Hardware Mfg., Inc.~~
- ~~b. Hager Companies.~~
- ~~c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.~~

~~2.032~~ 2.019 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Adhesive-Backed Perimeter Gasketing: Vinyl bulb gasket material applied to frame rabbet with self-adhesive. Gasketing applied to head and jamb of frame, forming seal between door and frame.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International product indicated below or a comparable product by one of the Alternate Manufacturers:

- a. Weatherstripping: 188S-Wh.
- b. Soundstripping: 188S-Wh.
- ~~c. Smoke gasketing: 188S-Wh.~~

- 2. Alternate Manufacturers:

- a. Hager Companies, (726W).
- b. National Guard Products, Inc., (5050W)
- c. Pemko Manufacturing Co., (PK55).
- d. Reese Enterprises, (797-W)

C. Astragal Gasket for Meeting Stiles: Gasket material held in place by aluminum housing; mounted with screws.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International product indicated below or comparable product by one of the Alternate Manufacturers:

- ~~a. Wood Doors: Pile type, adjustable, mortised into center of edge of door. (56D-456D).~~

- ~~b. Hollow Metal Doors: Pile type, spring loaded, screw adjustable, surface mounted on exterior face of door. (55AA-155AA).~~
- a. Hollow Metal or Wood/Fiberglass Doors, Where "magnetic astragal/meeting stile gasket" indicated: Self adjusting, magnetic, surface mounted on exterior face of door. (375A, 2 required)
- ~~e.b. Adjustable Door Sweep: Pile type, spring loaded, screw adjustable, surface mounted on exterior face of door. (255)~~

2. Alternate Manufacturers:

- a. Hager Companies.
- b. National Guard Products.
- c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
- d. Reese Enterprises.

~~D. Extended Nylon Brush Weatherstripping:~~

- ~~1. Basis of Design Product: Subject to compliance with requirements, provide Reese Enterprises, Inc 978C or comparable product by one of the following:~~
 - ~~a. National Guard Products.(1-615A)~~
 - ~~b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.(18400-NB)~~

~~E. Automatic Door Bottoms: Sponge neoprene or vinyl gasket material held in place by aluminum housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.~~

- ~~1. Basis of Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International product indicated below or comparable product by one of the Alternate Manufacturers:~~
 - ~~a. Wood Door and Interior Hollow Metal Door Mounting: Surface mounted on face; 365D or AA.~~
 - ~~b. Wood Door: Mortised in bottom edge of door; 364AA.~~
 - ~~c. Aluminum Door and Exterior Hollow Metal Door Mounting: Concealed in bottom channel of door; 355A.~~

~~2. Alternate Manufacturers:~~

- ~~a. Hager Companies.~~
- ~~b. National Guard Products.~~
- ~~c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.~~
- ~~d. Reese Enterprises, Inc.~~

F.D. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:

- ~~1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.~~
- 2.1. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
- 3.2. Gasketing on Double Doors: 0.50 cfm per foot (0.000774 cu. m/s per m) of door opening.

~~2.033~~2.020 THRESHOLDS

A. General

1. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch(13 mm) high.

B. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International products indicated in schedule or a comparable product by one of the following manufacturers. Additional product design requirements are specified by product number in the "Door Hardware Schedule" in Part 3 of this section:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.

~~2.034~~2.021 SLIDING DOOR HARDWARE

- A. Sliding ~~Pocket Door Hardware Track Assembly: BHMA A156.14;~~ ~~c~~Consisting of complete sets including rails, door trolleys, track hanger and spacers, valences, guide channels, supports, bumpers, floor guides, and accessories indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ~~Johnson, L. E., Products, Inc; 2000 Series Heavy Duty Pocket Door Frame Kit or a comparable~~ Hafele Slido D-Line 11 120P system, including but not limited to the following components product by one of the following:

- a. Door Track: Continuous length: Silver colored anodized aluminum, 32 mm height, rated for maximum of 264 pounds, 6 meter length (941.25.606).
- b. Ball Bearing Mounted Roller Running Gear: Provide each door panel with 2 running gears.
 - 1) One, soft, self-closing mechanism and release device.
 - 2) One, with shock absorber with retaining spring.
 - ~~a-~~3) Set with plastic door guide. Guide not used. (941.02.038). Two sets per opening required.
- c. Track Spacer for 1-3/4 inch Door Thickness: Silver colored anodized aluminum, 19 mm wide, 3 meter lengths (941.25.833) Two lengths required per opening.
- d. Track Clip-On Fascia: Silver colored anodized aluminum, 68 mm tall by 22.5 mm wide, 6 meter length (940.43.260)
- e. Track End Caps: Silver colored plastic end caps (941.25.035). Two caps required per opening.
- f. Metal Floor Guide Track: Aluminum, mill finish (940.42.203)
 - 1) Install in bottom channel of door with stainless steel flat head screws, countersink in rail, and spacers as required.
- g. Floor Guide Roller: Galvanized Steel (940.42.032) Two guides required per opening.

2. Aluminum Bar Spacer: 1 inch by 2 inch solid aluminum bar, 6063 Alloy.

b.a. Anchors to Masonry: Lag shield anchors with stainless steel flat head screws.

~~2.035~~ **FOLDING DOOR HARDWARE**

~~A. General: BHMA A156.14; complete sets including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~2.036~~ 2.022 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick aluminum, brass, bronze, or stainless steel as noted by Basis-of-Design product or finish indicated in Part 3 "Door Hardware Schedule" Article; with manufacturer's counter-sunk machine or self-tapping screw fasteners.

B. Size: 1- inch (25 mm) less than door width on push side and 1/2 inch(13 mm) less than door width on pull side, by height specified.

C. Isolate brass or bronze units from hollow metal doors to prevent electrolytic oxidation of protective trim.

D. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives product listed below or a comparable product by one of the Alternate Manufacturers:

1. Kick Plate: 8 inch height; 8400 B4E/CS.

~~2. Mop Plate: 4 inch height; 8400 B4E/CS.~~

~~3.2.~~ Door Armor: 30 inch height, 8400 B3E/CS.

~~4.3.~~ Alternate Manufacturers:

- a. Burns Manufacturing Incorporated.
- b. Hager Companies.
- c. Hiawatha, Inc; a division of the Activar Construction Products Group.
- d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
- e. Trimco.

~~2.037~~ **PLASTIC PROTECTION PLATES**

~~A. Plastic Protection Plates: BHMA A156.6; fabricated with four sides beveled; [plastic laminate; 1/8 inch (3.2 mm) thick; NEMA LD 3, Grade HGS] [rigid plastic; 0.060 inch (1.5 mm) thick, PVC or acrylic-modified vinyl plastic] [acrylic; 1/8 inch (3.2 mm) thick].~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~2.038~~ 2.023 AUXILIARY DOOR HARDWARE

~~A. Rain Drip at exterior doors.~~

~~1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Zero International #142 or comparable product by one of the following:~~

- ~~a. Hager Companies.~~
- ~~b. National Guard Products.~~
- ~~c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.~~
- ~~d. Reese Enterprises, Inc.~~

~~B.A.~~ Silencers for Metal Door Frames: Grade 1; neoprene or rubber; minimum diameter 1/2 inch (13mm); fabricated for drilled-in application to frame.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Ives SR 64 or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Burns Manufacturing Incorporated.
 - c. Hager Companies.
 - d. Trimco.

2.0392.024 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Door and Frame Electrical Power Transfer (EPT):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc, Von Duprin EPT 10 or comparable product by one of the following:
 - a. Precision Hardware, Inc.; a Stanley company.

~~B. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.~~

~~1. Electrified Exit Devices: Provide boxed power supply from same manufacturer as exit device.~~

~~C.B.~~ Door Position Switch: Concealed mount, flush mount electromagnetic sensing device mortised in head of door frame and top edge of door.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Allegion plc; Schlage 7764 or comparable product by one of the following:
 - a. Securitron Magnalock Corp.; an ASSA ABLOY Group company (MSS 1-C).

2.0402.025 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - ~~2. Fire-Rated Applications:~~
 - ~~a. Wood or Machine Screws: For the following:~~
 - ~~1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.~~
 - ~~2) Strike plates to frames.~~
 - ~~3) Closers to doors and frames.~~
 - ~~b. Steel Through Bolts: For the following unless door blocking is provided:~~
 - ~~1) Surface hinges to doors.~~
 - ~~2) Closers to doors and frames.~~
 - ~~3) Surface-mounted exit devices.~~
 - ~~3.2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.~~
 - ~~4.3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.~~

~~2.041~~2.026 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are 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.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- ~~B. Wood Doors: Comply with door and hardware manufacturers' written instructions.~~

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights ~~[indicated on Drawings]~~ [to comply with the following] unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - ~~2. Custom Steel Doors and Frames: HMMA 831.~~
 - ~~3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."~~
- B. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated ~~in door hardware schedule~~, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as ~~[indicated in keying schedule]~~ **[directed by Owner]**.
 2. Furnish permanent cores to Owner for installation.
- F. Key Control System:
1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
 2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
 3. Key Control System Software: Set up multiple-index system based on final keying schedule.
- ~~G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, [above accessible ceilings] [in equipment room]. Verify location with Architect.~~
- ~~1. Configuration: Provide [one power supply for each door opening] [least number of power supplies required to adequately serve doors] with electrified door hardware.~~
- ~~H.G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."~~
- ~~H.H. Stops: Provide floor stops for doors unless wall or other type stops otherwise are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.~~
- ~~H.I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.~~
- ~~1. Do not notch perimeter gasketing to install other surface-applied hardware.~~
- ~~K.J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.~~
- ~~L.K. Adjustable Door Bottoms Sweeps: Apply to bottom of door. Adjust to, forming seal with threshold when door is closed.~~

~~3.04~~ **FIELD QUALITY CONTROL**

- ~~A. Independent Architectural Hardware Consultant: [Owner will engage] [Engage] a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.~~
- ~~1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.~~

~~3.05~~ **3.04 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to

operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- ~~2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.~~
- ~~3.2.~~ Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

- B. Occupancy Adjustment: Approximately ~~[three]~~ [six] ~~<Insert number>~~ months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

~~3.06~~3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

~~3.07~~3.06 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include ~~[six]~~ [nine] [12] ~~<Insert number>~~ months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

~~3.08~~3.07 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

~~A.~~

3.08 DOOR HARDWARE SCHEDULE

~~3.09~~

PUSH/PULL HARDWARE SETS.

Door Hardware Set No. : PP 1

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
<u>2</u>	<u>Offset Pivot Set</u>		<u>Match Door and Frame</u>
<u>2</u>	<u>Entry Push</u>		<u>US 32D</u>
<u>2</u>	<u>Entry Pull</u>		<u>US 32D</u>
<u>1</u>	<u>Power Door Operator</u>	<u>Operates one door of pair. Specification Section 087113 Power Door Operators</u>	<u>Match Door and Frame</u>
<u>1</u>	<u>Concealed Closer</u>	<u>Provided with power door operator, mounted in head extrusion, with arm coordinated with door type</u>	<u>NA</u>
<u>2</u>	<u>Vestibule Floor Stop</u>		<u>US 26D</u>
	<u>Weatherstripping</u>	<u>By Frame Manufacturer</u>	

ENTRANCE HARDWARE SETS.

Door Hardware Set No. : ENT 1

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
<u>1</u>	<u>Continuous Hinge</u>		<u>Match Door and Frame</u>
<u>1</u>	<u>Lockset</u>	<u>Office Function (F20) Mortise Lockset</u>	<u>US 26D</u>
<u>1</u>	<u>Surface Closer</u>	<u>Integral Stop Arm</u>	<u>ANSI 689</u>
<u>1</u>	<u>Kickplate</u>		<u>US 32 D</u>
<u>1</u>	<u>Weatherstripping</u>		<u>White</u>
<u>1</u>	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>
<u>1</u>	<u>Adjustable Sweep</u>		<u>AA</u>

CLASSROOM HARDWARE SETS.

Door Hardware Set No. : C 1

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
	<u>Hinges</u>		<u>US 26D</u>
<u>1</u>	<u>Lockset</u>	<u>Classroom Function (F05) Mortise Lockset</u>	<u>US 26D</u>
<u>1</u>	<u>Wall Stop</u>		<u>US 26D</u>
<u>1</u>	<u>Kickplate</u>	<u>Install on terrazzo floor side of door</u>	<u>US 32D</u>
<u>1</u>	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>
<u>1</u>	<u>Soundstripping</u>		<u>White</u>

ELECTRIC LOCK HARDWARE SETS.

Door Hardware Set No. : EL1

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
<u>2</u>	<u>Hinges</u>		<u>US 26D</u>
<u>1</u>	<u>Electric Hinge</u>		<u>US 26D</u>
<u>1</u>	<u>Electrified Lockset</u>	<u>Fail Secure</u>	<u>US 26D</u>
<u>1</u>	<u>Surface Closer</u>	<u>Integral Stop Arm</u>	<u>ANSI 689</u>
<u>1</u>	<u>Kickplate</u>	<u>Install on terrazzo floor side of door</u>	<u>US 32D</u>

<u>1</u>	<u>Wall Stop</u>		<u>US 26D</u>
<u>1</u>	<u>Soundstripping</u>		<u>White</u>
<u>1</u>	<u>Threshold</u>	<u>Terrazzo to concrete transition; 1545</u>	<u>Mill</u>
<u>1</u>	<u>Door Position</u>		
	<u>Switch</u>		
<u>1</u>	<u>Card Reader</u>	<u>(By Allowance)</u>	

Door Hardware Set No. : EL1A
Same as set EL1, except omit threshold

Door Hardware Set No. : EL2

<u>1</u>	<u>Continuous Hinge</u>		<u>Match door color</u>
<u>1</u>	<u>Electrical Power</u>	<u>EPT-10</u>	<u>ANSI 689</u>
	<u>Transfer</u>		
<u>1</u>	<u>Electrified Lockset</u>	<u>Fail Secure</u>	<u>US 32D</u>
<u>1</u>	<u>Surface Closer</u>	<u>Integral Hold Open/Stop Arm</u>	<u>ANSI 689</u>
<u>1</u>	<u>Door Armor Plate</u>		<u>US 32D</u>
<u>1</u>	<u>Wall Stop</u>		<u>US 32D</u>
<u>1</u>	<u>Weatherstripping</u>		<u>White</u>
<u>1</u>	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>
<u>1</u>	<u>Adjustable Sweep</u>		<u>AA</u>
<u>1</u>	<u>Door Position</u>		
	<u>Switch</u>		
<u>1</u>	<u>Card Reader</u>	<u>(By Allowance)</u>	

Door Hardware Set No. : EL3

<u>2</u>	<u>Continuous Hinge</u>	<u>Wide Throw; 780-235-HD</u>	<u>Match door color</u>
<u>1</u>	<u>Electrical Power</u>	<u>EPT-10</u>	<u>ANSI 689</u>
	<u>Transfer</u>		
<u>1</u>	<u>Electrified Lockset</u>	<u>Fail Secure</u>	<u>US 32D</u>
<u>1 set</u>	<u>Flush Bolts</u>		<u>US 26D</u>
<u>1</u>	<u>Dustproof Strike</u>		<u>US 26D</u>
<u>1</u>	<u>Surface Closer</u>		<u>ANSI 689</u>
<u>2</u>	<u>Exterior Wall</u>		<u>US 28</u>
	<u>Stop/Holder</u>		
<u>2</u>	<u>Door Armor Plate</u>		<u>US 32D</u>
<u>1</u>	<u>Magnetic Meeting</u>		<u>AA</u>
	<u>Stile Gasket</u>		
<u>1</u>	<u>Weatherstripping</u>		<u>White</u>
<u>1</u>	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>
<u>2</u>	<u>Adjustable Sweep</u>		<u>AA</u>
<u>2</u>	<u>Door Position</u>		
	<u>Switch</u>		
<u>1</u>	<u>Card Reader</u>	<u>(By Allowance)</u>	

PRIVACY HARDWARE SETS.

Door Hardware Set No. : PR 1

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
<u>3</u>	<u>Gravity Hinges</u>		<u>US 26D</u>
<u>1</u>	<u>Lockset</u>	<u>Privacy Function (F21) Mortise Lockset</u>	<u>US 26D</u>
<u>1</u>	<u>Wall Stop</u>		<u>US 26D</u>

Door Hardware Set No. : PR 2 (Family Restroom Door)

<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>

1	<u>Hinges</u>		<u>US 26D</u>
	<u>Lockset</u>	<u>Special Privacy Function (Key Retracts</u>	<u>US 26D</u>
		<u>Deadbolt, Occupied Indicator) Mortise</u>	
		<u>Lockset</u>	
1	<u>Surface Closer</u>		<u>ANSI 689</u>
2	<u>Kickplate</u>	<u>Install on each side of door</u>	<u>US 32D</u>
1	<u>Wall Stop</u>		<u>US 26D</u>
<u>Door Hardware Set No. : PR 3</u>			
<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
1	<u>Continuous Hinge</u>		<u>US 26D</u>
1	<u>Lockset</u>	<u>Special Privacy Function (Key Retracts</u>	<u>US 26D</u>
		<u>Deadbolt, Occupied Indicator) Mortise</u>	
		<u>Lockset</u>	
1	<u>Surface Closer</u>	<u>With Integral Stop Arm</u>	<u>ANSI 689</u>
1	<u>Weatherstripping</u>	<u>By Frame Manufacturer</u>	
1	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>
1	<u>Adjustable Sweep</u>		<u>Mill</u>

EXIT DEVICE HARDWARE SETS.

<u>Door Hardware Set No. : E 1 (Aluminum Pair Exterior Entrance Door)</u>			
<u>Qty.</u>	<u>Item</u>	<u>Additional Information</u>	<u>Finish</u>
2	<u>Offset Pivot Sets</u>		<u>US 32D</u>
1	<u>Exit Device</u>	<u>9848NL – OP, LBR, CD</u>	<u>US 32D</u>
1	<u>Exit Device</u>	<u>9848EO - CD</u>	<u>US 32D</u>
1	<u>Power Door</u>	<u>Operates one door of pair. Specification</u>	<u>Match Door and</u>
	<u>Operator</u>	<u>Section 087113 Power Door Operators</u>	<u>Frame</u>
1	<u>Concealed Closer</u>	<u>Provided with power door operator, mounted in</u>	
		<u>head extrusion, with arm coordinated with door</u>	
		<u>type</u>	
2	<u>Entry Pulls</u>		<u>US 32D</u>
2	<u>Vestibule Floor</u>		<u>US 26D</u>
	<u>Stop</u>		
	<u>Weatherstripping</u>	<u>By Frame Manufacturer</u>	
	<u>Meeting Stile</u>	<u>By Door Manufacturer, fixed in edge of door</u>	
	<u>Weatherstripping</u>	<u>with screw.</u>	
1	<u>Threshold</u>	<u>Entrance; 65A</u>	<u>Mill</u>

Operation of Hardware Sets PP3 and E4: Both doors of pair normally unlocked/dogged. Power door operator activates one door of pair upon knowing action of pressing operator button. After a timed delay, the second operator in the sequence of vestibule openings begins operation of one door of second pair.

SLIDING DOOR HARDWARE SETS.

<u>Door Hardware Set No. : SL1 (Sliding Toilet Bay Entrance Door)</u>			
1	<u>Sliding Door Track</u>		
	<u>Assembly</u>		
2	<u>Surface Mounted</u>		<u>Clear Finished</u>
	<u>Drop Bolt</u>		<u>Aluminum</u>
	<u>Auxilliary Lock</u>		
2	<u>Cylinders</u>		<u>US 26D</u>
2	<u>Sliding Door Pulls</u>		<u>US 32D</u>
		<u>Printed Acrylic Panel and hardware for</u>	

mounting panel provided by allowance.

CYLINDER HARDWARE SETS.

Door Hardware Set No. : CYL 1 (Cylinder for hardware in other specification sections)

<u>1</u>	<u>Cylinder</u>	<u>US 26D</u>
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SWING GATE HARDWARE SETS.

Door Hardware Set No.: SG 1

<u>2</u>	<u>Hinge</u>	<u>Manufacturer's Standard Assembly</u>	<u>Match Gate</u>
<u>2</u>	<u>Pull</u>	<u>Manufacturer's Standard Assembly</u>	<u>Match Gate</u>
<u>2</u>	<u>Bolt</u>	<u>Manufacturer's Standard Assembly</u>	

Door Hardware Set No.: SG 2

<u>2</u>	<u>Hinge</u>	<u>Manufacturer's Standard Assembly</u>	<u>Match Gate</u>
<u>2</u>	<u>Pull</u>	<u>Manufacturer's Standard Assembly</u>	<u>Match Gate</u>
<u>2</u>	<u>Surface Mounted</u>	<u>Mount to gate with through bolts</u>	<u>Clear Finished</u>
	<u>Drop Bolt</u>		<u>Aluminum</u>
	<u>Auxilliary Lock</u>		

END OF SECTION 087100

SECTION 087113 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Custom, low-energy door operators compliant with BHMA A156.19 for swinging doors with integral concealed closers to control adjacent doors.

1.02 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- D. For automatic door terminology, see BHMA A156.19 for definitions of terms.

1.03 COORDINATION

- A. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.
- B. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- C. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:
 1. Power supplies.
 2. Access-control system.
 3. Remote activation devices.

1.04 PREINSTALLATION MEETINGS

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

1.05 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 power door operators.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
 - a. Review obstructions from structural steel framing and indicate paths under concrete slab necessary to complete wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard size.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of power door operator.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's special warranties.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
 1. Maintenance Proximity: Not more than three hours' normal travel time from Installer's place of business to Project site.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of power door operator, including controls.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Manufacturers known to offer products that comply with the requirements and may be incorporated into the Work include the following:
 1. Horton Automatics; Overhead Door Corporation.
- B. Source Limitations: Obtain power door operators, including activation and safety devices, from single source from single manufacturer.

2.02 POWER DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, off-set pivots, and activation and safety devices.
 1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load indicated in Drawings.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.
- C. Off-set Pivots: See Section 087100 "Door Hardware" for offset pivots at each door that door operators shall accommodate.
- D. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum and extending full width of door opening, including door jambs, to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
- E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components within enclosure.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Closer Concealed in Housing for Overhead Concealed Operators, Doors with Offset Pivots: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use.

Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Closer Incorporated in Basis-of-Design Product: Subject to compliance with requirements, provide CRL Jackson heavy duty closer with power door operators arm and track in head of door assembly made for operation from push side of door.

2.03 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.

C. Configuration, Pair: Operator to control one of pair of swinging doors, concealed closer controls the adjacent door.

1. Traffic Pattern: Two way.
2. Operator Mounting: Overhead concealed.

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical.

F. Microprocessor Control Unit: Solid-state controller.

G. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator; key operated.

H. Activation Device: Touchless switch at locations indicated in Drawings to activate door operator.

I. Exposed Finish: Finish to match adjacent doors and frame in type and color.

2.04 MATERIALS

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

1. Extrusions: ASTM B221 (ASTM B221M).
2. Sheet: ASTM B209 (ASTM B209M).

- B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.05 CONTROLS

- A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

- B. On/Off Switch; Keyed cylinder switch, key to building key system.

- C. Touchless Switch: Hands-free activation door-control switch with flat motion sensor face-plate with contrasting-colored, engraved message.

1. Configuration: .

- a. Inside Vestibule and Inside Exhibit Space; Wall Mounting: 4 1/2 inch by 2 3/4 inch (114-by-70-mm) (single gang) with rectangular face plate. Locate as indicated on Drawings, box recess mounted to bring edge of box flush with face of metal panel..
- b. Pedestal Mounting: 4 1/2 inch by 4 1/2 inch (114-by-114-mm) (double gang) with square face plate. Surface mounted to pedestal assembly per pedestal manufacturer's instructions.

- 1) Pedestal Basis-of-Design: Pedestal Pro model number 8BOL-PRO-001-304.
- 2) Pedestal mounted to concrete base with 3/4 inch diameter stainless steel threaded rod adhesive set in concrete. Minimum embedment in concrete of 3 1/2 inches (89 mm).

2. Face-Plate Material: Stainless steel .

3. Message: International symbol of accessibility and "Wave to Open" and wave symbol.

- D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.06 FABRICATION

- A. Factory fabricate power door operators to comply with indicated standards.

- B. Form aluminum shapes before finishing.

- C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

- E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints

with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.07 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.
- B. Apply organic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and inspect each power door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

- B. Power door operators will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 ADJUSTING

- A. Adjust power door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for tight closure.
- B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 086337 - "Edge Clamped Flush-Glazed Curtain Walls and Skylights" for requirements for installation of insulating units specified in this section utilizing structural-sealant-anchored channels with edge-clamped glazing systems.
2. Section 084426 - "Dichroic Glass Facade" for dichroic glazing panels and support systems.

1.02 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 in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.03 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site for each unique glazing system.
 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.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
 - 1. Tinted glass.
 - 2. Coated glass.
 - 3. Laminated glass.
 - 4. Insulating glass.
- C. Glazing Accessory Samples: For sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer, registered in the State of Indiana and responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of fabricated glass units, and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.07 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
- 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 C1021 to conduct the testing indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. 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 instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 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 are below 40 deg F (4.4 deg C).

1.010 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: 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 for 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.
- C. Manufacturer's Special Warranty for 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 obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Glass:
 - 1. Obtain tinted and coated glass in a single laminated glass type from single source from single manufacturer.
 - 2. Obtain each coated glass product from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Basic Wind Speed: 115 mph (51 m/s).
 - b. Exposure Category: B.
 - 2. Design Snow Loads: 20 psf minimum.
 - 3. Skylight Concentrated Load: 300 lbs.
 - 4. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - 5. 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 (25 mm), whichever is less.
 - 6. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- 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 6 mm thick.
 - 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, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.03 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. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. 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 the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Provide minimum of heat-strengthened float glass where fully tempered float glass is not indicated, except provide fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated or required to meet Indiana Building Code, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
1. Manufacturer as indicated in Laminated Glass Schedule for Reflective, Laminated One-Way Transparent Mirror Vision Glass.
- C. Fully Tempered Float Glass: ASTM C1048, 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. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, 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.
- E. Low-E-Coated Vision Glass: ASTM C1376.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Vitro Architectural Glass; Solarban 90, or a comparable product by one of the following:
 - a. Cardinal Glass Industries, Inc.; LoE-340.
 - b. Guardian Glass LLC.; SNX 51/23.
 - c. Viracon ; VNE-53.
- F. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

2.05 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. 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 to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.06 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction .
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.07 GLAZING SEALANTS

- A. General: Refer to section 086337 - "Edge Clamped Flush-Glazed Curtain Walls and Skylights" for structural and perimeter sealants.

2.08 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 C1281 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 primary sealant.

2.09 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:
 - 1. EPDM or silicone with Shore A durometer hardness of 85, plus or minus 5.
 - a. For edge clamped glazing, type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - a. For edge clamped glazing, type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. EPDM or silicone with Shore A durometer hardness per manufacturer's written instructions.
 - a. For edge clamped glazing, type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.010 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units 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.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 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.

3.02 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 leave visible marks in the completed Work.

3.03 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge

damage or other imperfections that, when installed, could weaken glass, impair performance, or impair 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 glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 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- (3-mm-) 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.
- G. 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 in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.04 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, then to jambs. Cover horizontal framing joints by applying tapes to jambs, 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 right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 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 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 in writing by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.06 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 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 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.

3.07 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type (GL-1): Fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

3.08 LAMINATED GLASS SCHEDULE

- A. Reflective, Laminated One-Way Transparent Mirror Vision Glass Type (SG-1): Two plies of fully tempered float glass.
 - 1. Basis-of-Design Product: Viracon; Viracon PLUS One-Way Transparent Mirror 9/16" VS1-08 Laminated.
 - 2. Outer Ply: Kind CV (coated vision glass).

- a. Coating Type: Sputter-coating (vacuum deposition process).
 - b. Coating Location: Second surface.
 - c. Coating Color: Silver.
3. Inner Ply: Tinted float glass.
- a. Tint Color: Gray.
4. Minimum Thickness of Each Glass Ply: 6 mm.
5. Interlayer Thickness: 0.060 inch (1.52 mm).
- a. Interlayer Color: Clear
6. Visible Reflectance to Subject: 42 percent maximum.
7. Visible Reflectance to Viewer: 12 percent maximum.
8. Visible Light Transmittance: 4 percent.
9. Safety glazing required.

3.09 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type (IGU-1):

1. Overall Unit Thickness: 1 inch (25 mm).
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: 10 percent Air, 90 percent Argon.
5. Indoor Lite: Heat-strengthened, except where fully tempered float glass is required to meet structural requirements, building code requirements, or is within 6 feet of building floor slab.
6. Low-E Coating: Sputtered on second surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53
7. Winter Nighttime U-Factor: 0.24 maximum.
8. Visible Light Transmittance: 39 percent minimum.
9. SGHC: 0.23 maximum.
10. Safety glazing required.

3.010 INSULATING-LAMINATED-GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Laminated Glass Type (IGU-2):

1. Overall Unit Thickness: Minimum 1-5/16 inch (33 mm).
2. Outdoor Lite: Laminated Clear Low-E Assembly.
 - a. Minimum Thickness of Each Glass Ply: 6 mm.

- b. Outer Ply: Heat-strengthened float glass, except where fully tempered float glass is required to meet structural requirements.
 - c. Interlayer Thickness: 0.060 inch (1.52 mm).
 - d. Inner Ply: Low-E coated heat-strengthened float glass, except where fully tempered is required to meet structural requirements.
 3. Interspace Content: 10 percent air, 90 percent argon.
 4. Minimum indoor lite thickness: Minimum of 6 mm.
 5. Indoor Lite: Clear fully tempered float glass.
 6. Low-E Coating: Sputtered on fourth surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53.
 7. Winter Nighttime U-Factor: 0.23 maximum.
 8. SGHC: 0.23 maximum.
 9. Shading Coefficient: 0.26 maximum.
- B. Low-E-Coated, Clear Insulating Laminated Glass Type (IGU-3):
 1. Overall Unit Thickness: Minimum 1-5/16 inch (33 mm).
 2. Minimum Thickness of Outdoor Lite: Minimum of 6 mm.
 3. Outdoor Lite: Clear fully tempered float glass.
 4. Interspace Content: 10 percent air, 90 percent argon.
 5. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass, except where fully tempered float glass is required to meet structural requirements.
 - a. Minimum Thickness of Each Glass Ply: 6 mm.
 - b. Interlayer Thickness: 0.060 inch (1.52 mm).
 6. Low-E Coating: Sputtered on second surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53
 7. Winter Nighttime U-Factor: 0.23 maximum.
 8. SGHC: 0.25 maximum.
 9. Shading Coefficient: 0.25 maximum.
- C. Frit and Low-E-Coated, Clear Insulating Laminated Glass Type (IGU-4):
 1. Overall Unit Thickness: Varies as needed to meet structural performance requirements.
 2. Outdoor Lite: Clear tempered glass.
 - a. Minimum Thickness: 6 mm.

- 1) Provide 9mm where required to meet structural performance requirements.
 - b. Outdoor Lite Frit Coating: White Ceramic Frit silk-screened on the second surface.
 - 1) Pattern: Standard hole pattern providing 60 percent coverage of surface.
 3. Interspace Content: 10 percent air, 90 percent argon.
 4. Indoor Lite: Clear laminated glass with two plies of heat-strengthened except where fully tempered is required to meet structural requirements.
 - a. Minimum Thickness of Each Glass Ply: 6 mm.
 - 1) Provide 9mm where required to meet structural performance requirements.
 - b. Interlayer Thickness: Minimum of 0.060 inch (1.52 mm).
 - 1) Modify thickness and type as necessary to meet structural performance requirements.
 5. Low-E Coating: Sputtered on fifth surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53
 6. Winter Nighttime U-Factor: 0.23 maximum.
 7. SGHC: 0.25 maximum.
 8. Shading Coefficient: 0.25 maximum.
- D. Low-E-Coated, Clear Insulating Laminated Glass Type (IGU-5):
1. Overall Unit Thickness: 1 inch (25 mm).
 2. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 3 mm.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm).
 3. Interspace Content: 10 percent air, 90 percent argon.
 4. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 3.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm).
 5. Low-E Coating: Sputtered on fourth surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53

6. Winter Nighttime U-Factor: 0.25 maximum.
7. SGHC: 0.22 maximum.
8. Shading Coefficient: 0.27 maximum.

E. Low-E-Coated, Clear Insulating Laminated Glass Type (IGU-6):

1. Overall Unit Thickness: 1 inch (25 mm).
2. Minimum Thickness of Outdoor Lite: 6 mm.
3. Outdoor Lite: Clear fully tempered float glass.
4. Interspace Content: 10 percent air, 90 percent argon.
5. Indoor Lite: Laminated glass with two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 3 mm.
 - b. Interlayer Thickness: Two layers as follows.
 - 1) Colored Interlayer Product: Vanceva #000F Interlayer; "Polar White" PVB.
 - a) Thickness: 0.015 inch.
 - 2) Clear PVB Interlayer.
 - a) Thickness: 0.015 inch.
6. Low-E Coating: Sputtered on second surface.
 - a. Basis-of-Design Product: Provide Vitro Solarban 90 Low-E glass or the listed alternate from the following alternate manufacturers.
 - 1) Cardinal Glass Industries, Inc.; LoE-340.
 - 2) Guardian Glass LLC.; SNX 51/23
 - 3) Viracon ; VNE-53
7. Visible Light Transmittance: 7 percent maximum.
8. Winter Nighttime U-Factor: 0.23 maximum.
9. SGHC: 0.25 maximum.
10. Shading Coefficient: 0.25 maximum.

END OF SECTION 088000

SECTION 088400 - PLASTIC 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Monolithic acrylic panels with direct printed custom graphics.
 - 2. Panel mounting to sliding hollow metal doors with standoffs.

1.3 ALLOWANCES

- A. Work in this section is part of listed Allowance.

1.4 COORDINATION

- A. Owner will select and provide digital artwork to be printed on acrylic panels. Coordinate requirements for digital file with Owner to maintain compatibility with printer. Advise Owner on image density requirements to maintain visual quality in printer output.
- B. Coordinate glazing standoff locations to provide necessary bite on plastic panels, minimum edge and face clearances, and adequate support by hollow metal door, 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 install acrylic panels.
 - 2. Review and approve proposed material storage locations.
 - 3. Review temporary protection requirements for plastic panels during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Plastic Panel Samples: For each color and finish of plastic glazing indicated, 12 inches (300 mm) square and of same thickness indicated for final Work.

- C. Glazing Accessory Samples: For standoffs. Approved sample will be returned to Contractor and may be incorporated into the work provided it remains undamaged through submittal and review process.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For plastic panel products.
- B. Product Test Reports: For plastic panels, for tests performed by a qualified testing agency.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plastic glazing to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Sample Panel: Provide 24 inch by 24 inch sample panel to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect plastic panels according to manufacturer's written instructions. Prevent damage to plastic panels from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Maintain protective coverings on plastic panels to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install panels until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acrylic art panel fabricator will be selected by Owner. Panels will be obtained from a single source.

2.2 PERFORMANCE REQUIREMENTS

- A. Plastic panels shall withstand normal temperature changes and impact loads without failure, including loss or breakage of plastic sheets attributable to the following: deterioration of plastic sheet, or other defects in materials and installation.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on plastic glazing and glazing framing members.
- C. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
 - 1. Self-ignition temperature of 650 deg F (343 deg C) or higher when tested according to ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
 - 2. Smoke density of 75 or less when tested according to ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
 - 3. Compliance with Class CC2 combustibility rating.
 - a. Burning rate of 2.5 in./min. (1.06 mm/s) or less when tested according to ASTM D635 at thickness indicated for the Work.
 - 4. Flame-spread index of not less than that indicated when tested according to ASTM E84.

2.3 PLASTIC GLAZING, GENERAL

- A. Glazing Publication: Comply with published instructions of plastic glazing manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated. See this publication for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.
- B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

2.4 MONOLITHIC ACRYLIC GLAZING

- A. Plastic Glazing: Transparent Acrylic Sheet; Acrylic sheet produced specifically for receiving digitally printed images on back face and mar-resistant front face (Markerboard type).
 - 1. Nominal Thickness: 0.354 inch (2.5 mm).
 - 2. Color: Colorless.
 - 3. Combustibility Class: CC2.
 - 4. Products: Subject to compliance with requirements, available manufacturer's products that may be incorporated into the Work include, but are not limited to the following:
 - a. ACRYLITE Digital Print Markerboard Clear.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. Standoffs: 2-inch diameter stainless steel glass railing standoff.
 - 1. Finish: Brushed.

2. Provide threaded stud matched to threads of cap and of length.
3. Provide set of standoff spacers to achieve 3/8-inch gap between panel and door.
4. Basis-of Design: C.R. Laurence
 - a. Cap Assembly: RCAP2BS tapped for 3/8-inch -16 stainless steel threaded rod.
 - b. Standoff Spacers, 1/8-inch thickness: RSOBS18BS.
5. Rivnut Fasteners: Anchor threaded rod to hollow metal door with stainless steel rivet nuts set in face panel of door.

2.6 FABRICATION

- A. Sizes: Fabricate plastic panels to sizes required by details in Drawings. Allow for thermal expansion and contraction of panels without restraint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plastic panels, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Minimum required clearances to accommodate standoffs.
 3. Doors have received final finish and that finish has been accepted by Owner.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean panels and door faces immediately before installation.
- B. Layout location of rivet nuts to receive standoff assemblies using removable tape. Do not mark locations direct to door finish until layout is complete and verified with holes in panels.

3.3 INSTALLATION

- A. Comply with combined written instructions and approved shop drawings prepared by manufacturers of plastic panels, standoffs, and other materials unless more stringent requirements are indicated in Drawings.
- B. Protect plastic panel surfaces from abrasion and other damage during handling and installation, according to the following requirements:
 1. Retain plastic panel manufacturer's protective covering or protect by other methods according to manufacturer's written instructions.
 2. Remove covering at border of each piece before setting panels in standoffs; remove remainder of covering immediately after installation where panels are exposed to sunlight or where other conditions make later removal difficult.

3. Remove damaged plastic panels from Project site and legally dispose of off-site. Damaged plastic panels are those containing imperfections that, when installed, result in weakened glazing and impaired performance and damaged appearance of direct printed artwork.

3.4 CLEANING AND PROTECTION

- A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.
- B. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.
- C. Wash plastic glazing according to plastic glazing manufacturer's written instructions.

END OF SECTION 088400

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum and formed-metal louvers.

1.02 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Sample Warranties: For manufacturer's special warranties.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers 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. Wind pressures are considered to act normal to the face of the building.
 - 1. Wind Loads:
 - a. Determine loads based on pressures as indicated on Drawings.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Nondrainable-Blade Louver, Extruded Aluminum (Wall Vent):
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck Thinline Louver ESJ-202 or comparable product by one of the following:
 - a. Airline Louvers; Mestek, Inc.; AS15B30H
 - b. Airolite Company, LLC (The); AC 155.
 - c. Construction Specialties, Inc.; 2252
 - d. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.: ELF 211.
 - 2. Louver Depth: 2 inches (50 mm).
 - 3. Blade Profile: Plain blade without center baffle.
 - 4. Size for Wall Vent at Welcome Center: 14 inches by 14 inches.
 - 5. Size for Exhaust Vent at Trucker Restroom: 16 inches high by 22 inches long to fit in masonry coursing of CMU and limestone veneer.
 - 6. Frame Type: Flanged frame for surface mount installation.
 - 7. Insect Screen.
 - 8. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm).
 - 9. Louver Performance Ratings:
 - a. Free Area: Not less than 0.5 sq. ft. .
- B. Horizontal Double Drainable-Blade Louver, Extruded Aluminum:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Greenheck Fan Corporation; EHM-601 or a comparable product by one of the following:
 - a. Airline Louvers; Mestek, Inc.
 - b. Airolite Company, LLC (The).
 - c. Construction Specialties, Inc.
 - d. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
 - 2. Louver Depth: 6 inches (150 mm).
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - 4. Mullion Type: Concealed.
 - 5. Louver Performance Ratings:
 - a. Free Area: Not less than 7.9 sq. ft. (0.735 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than 1050 fpm (5.3 m/s).
 - c. Air Performance:

- 1) Not more than 0.10-inch wg (25-Pa) static pressure drop at 800-fpm (4.1-m/s) free-area intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face with location of bottom of screen frame modified as indicated in Drawings.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames or bottom blade with stainless steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Mill finish unless otherwise indicated.
 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
1. Bird Screening, Aluminum: 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.05 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.06 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at equal spacings, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
- F. Provide subsills made of same material as louvers as indicated in Drawings for recessed louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.07 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: Match Architect's sample, equal to Valspar Floropon "Ash Gray" 432B161 .

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and openings, 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.

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Coordinate birdscreen installation with construction of plenum behind louver to drain water from bottom of plenum over top flange of louver sill back to the building exterior. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Horizontal Deflection: For non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft. (480 Pa).

- B. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- C. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1 inch (25 mm).

2.02 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C645 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: Comply with ASTM C645; ASTM A653/A653M, G40 (Z120); or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: ASTM C645.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. Jaimes Industries.
 - c. MarinoWARE.
 - d. MBA Building Supplies.
 - e. Mill Steel Framing; Mill Steel Company.
 - f. MRI Steel Framing, LLC.
 - g. Telling Industries.
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection, but not less than 0.0269 inch (0.683 mm).
 - 3. Depth: As indicated on Drawings.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).
- D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: Coordinate with punched openings in metal studs.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

2.03 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.
- D. Framing Members:
 - 1. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
 - b. Depth: As indicated on Drawings.
- E. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.04 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel 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 the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 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.
 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
- 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 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 that penetrate 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. Framed Openings: Frame openings other than door openings as indicated in Drawings.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.05 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches (1219 mm) o.c.
- 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 rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. 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.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Gypsum ceiling board.
3. Abuse-resistant gypsum board.
4. Mold-resistant gypsum board.
5. Interior trim.
6. Aluminum trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.03 MOCKUPS

A. Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install 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.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.02 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.

2.03 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. USG Corporation.
 2. Thickness: 5/8 inch (15.9 mm).

3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
2. Thickness: 1/2 inch (12.7 mm).
3. Long Edges: Tapered.

C. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Georgia-Pacific Gypsum LLC.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. USG Corporation.
2. Core: 1/2 inch (12.7 mm), regular type.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.04 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material:

- a. Typical: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - b. Where gypsum board abuts structural steel or metal components of glazing systems: Plastic extra deep reveal to receive backer rod and sealant.
 - 1) Plastic Components: F222-50R.
2. Shapes:
- a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Gordon Inc.
 - c. Pittcon Industries.
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
 4. Basis-of-Design components.
 - a. Reveals in north wall of exhibit space: Fry Reglet, DRM-625-25.

2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.06 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- 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.

3.02 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- 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 (1.5 mm) 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. Cover interior face of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) 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- (6.4- to 9.5-mm-) wide joints to install sealant.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Type X: As indicated on Drawings, typical for vertical surfaces.
 2. Ceiling Type: Horizontal or sloped ceiling surfaces.
 3. Abuse-Resistant Type: Bottom 8 feet of walls in Exhibit Space.
 4. Mold-Resistant Type: Ceilings in Family Restrooms.
- B. 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 and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 INSTALLATION OF 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. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated on Drawings
 4. Plastic Deep Reveal Bead: Where panel edges abut structural steel framing or glazing systems.
- C. Aluminum Trim: Install in locations indicated on Drawings.

3.05 FINISHING OF 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 for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.06 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

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Porcelain tile.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.02 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

- B. Face Size: Actual tile size, excluding spacer lugs.

- C. Module Size: Actual tile size plus joint width indicated.

1.03 PREINSTALLATION MEETINGS

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

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.04 ACTION SUBMITTALS

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

- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

- C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification for large format tile and substrate preparation.

***** [OR] *****
 - 2. Installer's supervisor for project is a Ceramic Tile Education Foundation Certified Installer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of each type of wall tile installation.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store liquid materials in unopened containers and protected from freezing.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar and grout component from single manufacturer.

2.02 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.03 TILE PRODUCTS

- A. Porcelain Tile Type [CT1, CT2, CTB1]: Unglazed.
 - 1. Products: Subject to compliance with requirements, provide the products listed in the size indicated in the Finish Legend in the Drawings.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size Variation: Rectified.
 - 4. Thickness: 3/8 inch (9.5 mm).
 - 5. Face: Plain with square edges.
 - 6. Grout Color: As selected by Architect from manufacturer's full range.
 - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Porcelain Tile Base: Surface bullnose..

2.04 SETTING MATERIALS

- A. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness up to 1/2 inch (12.5 mm).
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Versa Bond-LFT Professional Large Format Tile Mortar.

- b. Laticrete International, Inc.; 4-XLT Rapid.
 - c. MAPEI Corporation; Large-Format Floor and Wall Tile Mortar.
 - d. H.B. Fuller Construction Products Inc. / TEC; Ultimate Large Tile Mortar.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.05 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Building Products.
 - b. H.B. Fuller Construction Products Inc. / TEC.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
2. Polymer Type:
 - a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.06 MISCELLANEOUS MATERIALS

A. Large Format Tile Leveling System: Plastic assembly with insert that sets behind the back face of tile and mechanism to pull adjacent tile flush with each other at the joint, maintaining the specified joint width.

1. Available products that may be utilized in the Work include but are not limited to the following.
 - a. Miracle Sealants; Levelution.
 - b. Perfect Level Master; T-Lock Tile Leveling System.
 - c. Raimondi. R.L.S. Vite System or R.L.S. System.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.

1. Products.
 - a. Welcome Center Men's and Women's Toilets: Schluter Systems L.P.: Schiene, sized for depth of medium bed mortar and tile combined thickness.
 - b. Trucker Restrooms: Schluter Systems L.P.: Rondec, Stainless Steel.
 - 1) Size: Provide size to match tile thickness to be embedded in mortar as indicated in drawings.
 - 2) Accessories: Provide inside corner, outside corner, and end cap accessories necessary to provide complete assembly at end wall and top of wall conditions.

- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.07 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile have been completed.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in pattern indicated in, and as located in, the Drawings. Provide uniform joint widths unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain Tile: 3 mm.
- F. Metal Edge Strips: Install at locations indicated in Drawings and as detailed.

3.04 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.05 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.06 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Masonry or Concrete:
 - 1. TCNA W202 : Thinset mortar.

- a. Ceramic Tile Type: Porcelain.
- b. Thinset Mortar: Medium-bed, modified dry-set mortar.
- c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Related Requirements:

1.03 PREINSTALLATION MEETINGS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch- (150-mm-) square samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
- D. Delegated-Design Submittal: For seismic restraints for ceiling systems.
 - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

- C. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

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

1.07 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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed, but not less than 1 box of full panels.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL PANELS (ACP)

- A. Manufacturers: Subject to compliance with requirements, provide the listed product by one of the following:
 - 1. Armstrong Ceiling & Wall Solutions; Ultima.
 - 2. CertainTeed; SAINT-GOBAIN: Symphony.
 - 3. USG Corporation, Mars.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
 - 2. Pattern: E (lightly textured).
- D. Color: White .
- E. Light Reflectance (LR): Not less than 0.85 .
- F. Ceiling Attenuation Class (CAC): Not less than 35.
- G. Noise Reduction Coefficient (NRC): Not less than 0.80.
- H. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members .
- I. Thickness: 7/8 inch (22 mm).
- J. Modular Size: 24 by 24 inches (610 by 610 mm).
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.04 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Ceiling & Wall Solutions.
 - 2. CertainTeed; SAINT-GOBAIN.
 - 3. USG Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
 - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: aluminum.
 - 5. Cap Finish: .

2.05 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.
- C. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.06 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Ceiling & Wall Solutions.
 - 2. CertainTeed; SAINT-GOBAIN.
 - 3. USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.03 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure angle hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.

9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels in a basket-weave pattern.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Install impact clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3.04 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch (3 mm) in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch (3 mm) in 3.6 m), non-cumulative.

3.05 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096623 - RESINOUS MATRIX TERRAZZO 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. Thin-set, epoxy-resin terrazzo flooring.
2. Precast epoxy-resin terrazzo units.
3. Precast epoxy-resin benches.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.

1.3 ALLOWANCES

- A. Work in this section is part of listed Allowance.

1.4 PREINSTALLATION MEETINGS

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

1. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Review special terrazzo designs and patterns.
 - d. Verify joint and divider strip locations with field conditions.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
 2. Control-joint strips.
 3. Accessory strips.
 4. Abrasive strips.
 5. Precast terrazzo jointing and edge configurations.
 6. Terrazzo patterns.
 7. Precast terrazzo base sizes and configurations.
 8. Precast terrazzo bench assembly, including sections, dimensions, and supporting substructure.
- C. Samples for Initial Selection: Review design intent with Architect and Owner prior to preparation of samples of potential terrazzo colors and patterns. NTMA's "Terrazzo Color Palette" will be used as reference for colors and patterns available for each terrazzo type.
1. Provide multiple samples for up to two colors for terrazzo floor and one color for precast terrazzo benches.
- D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:
1. Terrazzo: 6-inch- (150-mm-) square Samples.
 2. Precast Terrazzo: 6-inch- (150-mm-) square Samples.
 3. Accessories: 6-inch- (150-mm-) long Samples of each exposed strip item required.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Material Certificates: For each type of terrazzo material or product.
 - C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
 - D. Preinstallation moisture-testing reports.
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For terrazzo to include in maintenance manuals.
- 1.8 QUALITY ASSURANCE
- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockups for terrazzo including accessories.
 - a. Size: Minimum 100 sq. ft. (9 sq. m) of typical poured-in-place flooring and base condition for each color and pattern in locations directed by Architect.

b. Include base.

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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
- C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.
- B. Mix Color and Pattern: As proposed by selected terrazzo installer and selected by Architect and Owner. Terrazzo samples may include aggregate and resin types as represented by NTMA's "Terrazzo Color Palette" EI through EIV Series.
- C. Materials:
 - 1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D412.
 - a. Reinforcement: Fiberglass scrim.
 - 3. Primer: Manufacturer's product recommended for substrate and use indicated.
 - 4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:
 - 1) Hardness: 60 to 85 per ASTM D2240, Shore D.
 - 2) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D412.
 - 3) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D695, Specimen B cylinder.
 - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.
 - a) Distilled water.
 - b) Mineral water.
 - c) Isopropanol.
 - d) Ethanol.
 - e) 0.025 percent detergent solution.
 - f) 1.0 percent soap solution.
 - g) 5 percent acetic acid.
 - h) 10 percent sodium hydroxide.
 - i) 10 percent hydrochloric acid.
 - j) 30 percent sulfuric acid.
 - b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch (6.35-mm) nominal thickness, and cured for 7 days at 75 deg F (24 deg C) plus or minus 2 deg F (1 deg C) and at 50 percent plus or minus 2 percent relative humidity.
 - 1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch (6.35 mm) according to ASTM D635.

- 2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) according to ASTM C531.
5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
6. Finishing Grout: Resin based.

2.4 PRECAST EPOXY-RESIN TERRAZZO

- A. Precast Terrazzo Base: Minimum 3/8-inch- (10-mm-) thick, epoxy terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm). Comply with manufacturer's written instructions for fabricating precast terrazzo base units in sizes and profiles indicated.
 1. Type: Provide sizes and configurations as indicated in Drawings.
 2. Top Edge: Slightly beveled with polished top surface.
 3. Outside Corner Units: With finished returned edges at outside corner.
 4. Color, Pattern, and Finish: Final selection to be made with approval of floor color sample. Design intent is to match color, pattern and finish of adjacent poured-in-place terrazzo flooring.
- B. Precast Terrazzo Benches: Minimum 1-inch (24-mm) thick, epoxy terrazzo assembly over supporting steel frame. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch (3.2-mm) radius.
 1. Color, Pattern, and Finish: Final selection to be made with approval of floor color sample. Design intent is to contrast with color, pattern and finish of adjacent poured-in-place terrazzo flooring.

2.5 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.
 1. Material: White-zinc alloy or aluminum as determined with selected floor color.
 2. Top Width: 1/8 inch (3.2 mm) typical. Wider dimension strips may be incorporated into select areas of final design.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 1. Edge-bead strips for exposed edges of terrazzo.

2.6 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.
- B. Anchoring Devices:
 - 1. Precast Terrazzo Base: Provide mechanical anchoring devices or adhesives for base materials as recommended by manufacturer and as required for secure attachment to substrate.
 - 2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.
 - 1. Surface Friction: Not less than 0.6 according to ASTM D2047.
 - 2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and 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, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 - 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

- a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
- D. Preinstallation Moisture Testing:
1. Testing Agency: Engage a qualified testing agency to perform tests.
 2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours when tested according to ASTM F1869 using anhydrous calcium chloride.
 - b. Relative Humidity Test: Maximum 75 percent relative humidity measurement when tested according to ASTM F2170 using in-situ probes.
 3. Proceed with terrazzo installation only after concrete substrates pass moisture testing or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.
- E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.
1. Install concrete substrates that fail preinstallation moisture testing.
- F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.
1. Prepare and prefill substrate cracks with membrane material.
 2. Install membrane at substrate cracks in areas to receive terrazzo.
 3. Reinforce membrane with fiberglass scrim.
- G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Strip Materials:
 1. Divider and Control-Joint Strips:

- a. Locate divider strips and control-joint locations indicated in final approved shop drawings.
 - b. Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
2. Accessory Strips: Install as required to provide a complete installation and in locations indicated.
- C. Apply primer to terrazzo substrates according to manufacturer's written instructions.
- D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.
1. Installed Thickness: 3/8 inch (9.5 mm) nominal.
 2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 - a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.
 - b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.
 - c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 80 then 120-grit stones or with comparable diamond abrasives until grout is removed from surface.
 3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/8 inch in 10 feet ; noncumulative.

3.4 PRECAST TERRAZZO INSTALLATION

- A. Install precast terrazzo units using method recommended in writing by NTMA and manufacturer unless otherwise indicated.
- B. Do not install units that are chipped, cracked, discolored, or improperly finished.
- C. Seal joints between units in same plane with joint compound matching precast terrazzo matrix. Seal joints between units at inside corners with joint sealant.

3.5 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.6 CLEANING AND PROTECTION

- A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Sealing:
1. Seal surfaces according to NTMA's written recommendations.
 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Modular carpet tile.

1.03 PREINSTALLATION MEETINGS

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

- 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.04 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 manufacturer's written installation recommendations for each type of substrate.

- B. Shop Drawings: For carpet tile installation, plans showing 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. Transition details to other flooring materials.

C. 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.

D. Samples for Verification: 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.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.05 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.

1.06 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.

1.07 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 10 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this section, who has specialized in installing carpet required for this project and with a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown in Drawings.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard".

1.010 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's "Installation Standards" 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 levels planned for building occupants 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. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.011 WARRANTY

- A. Warranty for Carpet Tiles: Manufacturer standard warranty.
 1. Warranty Period: Manufacturers standard warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CARPET TILE (CPT)

- A. Manufacturer, Color, Pattern and Size: As indicated in Finish Legend in Drawings.
- B. Performance Characteristics:
 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 2. Smoke Density: Less than 450, when rated by ASTM E662.

2.02 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 comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.01 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.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's "Carpet Installation Standard" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- 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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's "CRI Carpet Installation Standard", Section 18, "Modular Carpet" 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. Maintain pile-direction patterns as indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Do not bridge building expansion joints with carpet tile.
- J. Install custom cut logo tile according to manufacturer's written instructions and as indicated in Drawings.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive 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 the Carpet and Rug Institute's "Carpet Installation Standard", Section 20, "Protecting Indoor Installations".

END OF SECTION 096813

SECTION 099114 - EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on the following exterior substrates:
 - a. Concrete masonry units (CMUs).
 - b. Steel and iron.
 - c. Galvanized metal.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 099600 "High-Performance Coatings" for coatings over structural steel exposed to the weather at Welcome Center and Trucker Restrooms.

1.03 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
3. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.

4. Label each Sample for location and application area.

E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.05 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. (3.8 L) of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

- a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
- b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on 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.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 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 (7 deg C).

- 1. Maintain containers in clean condition, free of foreign materials and residue.
- 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints; PPG Industries, Inc.
 - 3. The Sherwin-Williams Company.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Master Painters Institute (MPI) approved products list for the paint category indicated in the Exterior Painting Schedule at the end of this section.
- C. Source Limitations: Obtain paint from single source from single manufacturer.

2.02 PAINT PRODUCTS

- A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range for each condition.

PART 3 - EXECUTION

3.01 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. Masonry (CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems 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.
- 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. 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. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. 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. Comply with SSPC SP-1.

3.03 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."
 - 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. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 4. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint 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.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
- 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.

3.05 EXTERIOR PAINTING SCHEDULE

- A. CMU Substrates (CMU wall surfaces in equipment courtyards of Welcome Center and Storage Building):
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Low-Sheen Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
- B. Steel and Iron Substrates (Downspout Boots, Architectural Steel Frame at Trucker Restrooms):
 - 1. Water-Based Light Industrial Coating over Epoxy System:
 - a. Prime Coat: Primer, epoxy, anti-corrosive MPI #101.
 - b. Intermediate Coat: Epoxy, high build, low gloss MPI #108.
 - c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.

- C. Galvanized-Metal Substrates (Dumpster Pipe Bollards, Loose Steel Lintels, Prefabricated Swing Gate Hinge Posts):
 - 1. Water-Based Light Industrial Coating System:
 - a. Epoxy Prime Coat: Primer, epoxy, anti-corrosive, MPI #101.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level 5), MPI #163.

END OF SECTION 099114

SECTION 099124 - INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Cement board.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of exposed, interior structural steel columns.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications with primers specified in this section.
 - 3. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with primers specified in this section.
 - 4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - 5. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.03 DEFINITIONS

- A. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. 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 (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.05 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. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.06 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.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on 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.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Architectural Coatings.
 - 3. The Sherwin-Williams Company.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Master Painters Institute (MPI) approved products list for the paint category indicated in the Interior Painting Schedule at the end of this section.

2.02 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: Match Architect's samples, as indicated by Basis of Design manufacturer's product designation in Finish Legend in Drawings.

PART 3 - EXECUTION

3.01 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 (CMUs): 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. 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.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems 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. 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. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. 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.

- G. Aluminum Substrates: Remove loose surface oxidation.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 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. Metal conduit.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces black.

3.04 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.

3.05 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.

3.06 INTERIOR PAINTING SCHEDULE

- A. Cement Board Substrates (Panels Behind Solid Surface Panels at Hand Dryers):
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.
- B. CMU Substrates (Offices, Mechanical Spaces):
 - 1. High-Performance Architectural Latex System:
 - a. Block Filler: Latex, interior/exterior, MPI #4.
 - b. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat (Offices): Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
 - e. Topcoat (Mechanical Spaces and Chases of Welcome Center and Trucker Restroom): Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5), MPI #141.
- C. Steel Substrates (Shop Primed Doors and Frames, Exposed Structural Columns, Pipe Railings, Exposed Roof Deck and Supporting Framing):
 - 1. Water-Based Light-Industrial Coating System (Shop Primed Doors and Frames):
 - a. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - b. Topcoat: Light-industrial coating, interior, water based, semigloss (MPI Gloss Level 5), MPI #153.
 - 2. Water-Based Light-Industrial Coating System over Epoxy Primer System (Exposed Structural Steel Columns, Pipe Railings):

- a. Prime Coat: Primer, epoxy, anti-corrosive MPI #101.
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based, semigloss (MPI Gloss Level 5), MPI #153.
3. Water-Based Dry-Fall System (Exposed Roof Deck and Supporting Framing):
- a. Prime Coat:
 - 1) Metal Deck: Factory primer specified in Section 053100 Steel Decking..
 - 2) Structural Steel Prime Coat: Primer, quick dry, for shop application, MPI #275.
 - 3) Plywood Deck Primer: Primer, latex, for interior wood, MPI #39
 - b. Topcoat: Dry fall, latex (MPI Gloss Level 3), MPI #155.
- D. Galvanized-Metal Substrates (Factory Primed Doors, Frames and Surface Mounted Electrical):
1. Water-Based Light-Industrial Coating System:
 - a. Prime Coat (Surface Mounted Electrical Conduit and Boxes): Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based, semigloss (MPI Gloss Level 5), MPI #153.
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates (Corner Guard Assemblies):
1. Latex System:
 - a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
 - b. Intermediate Coat and Topcoat same as adjacent gypsum board.
- F. Gypsum Board Substrates:
1. High-Performance Architectural Latex System (Exhibit Room Walls/Ceilings, Bulkheads):
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat (Welcome Center Men Toilets, Women Toilets and Vending Ceilings/Bulkheads, Exhibit Room Walls and Ceilings Painted PT-1): Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
 - d. Topcoat (Exhibit Room Walls and Ceilings Painted PT-4): Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.
 2. Water-Based Light-Industrial Coating System(Family Restroom Gypsum Board Ceilings):
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.

END OF SECTION 099124

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood stains.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

C. Samples for Verification: Sample for each type of finish system and in each color and gloss of finish required on representative samples of actual wood substrates.

1. Size: 8 inches (200 mm) long.
2. Apply coats on Samples in steps to show each coat required for system.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: 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. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.4 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 (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations: Obtain each coating product from single source from single manufacturer.

2.2 MATERIALS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2.3 WOOD STAINS

- A. Stain, Exterior, Solvent Based, Semitransparent: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new wood surfaces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Benjamin Moore & Co.; ARBORCOAT Semi Transparent Stain.
 - b. PPG Paints; PPG Industries, Inc.; Stain, Exterior, Solvent Based, Semitransparent.
 - c. Sherwin-Williams Company (The); DeckScapes Exterior Oil Semi-Transparent Stain.
 - 2. Stain Colors: As selected by Architect from Manufacturer's full range of colors.

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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- C. Interior Wood Substrates:
 - 1. Sand surfaces exposed to view and dust off.
 - 2. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

- A. Wood Substrates, Wood Trim and Wood Board Paneling:
 - 1. Semitransparent Stain System:
 - a. Prime Coat: Stain, exterior, solvent based, semitransparent, matching topcoat.
 - b. Topcoat: Stain, exterior, solvent based, semitransparent.

END OF SECTION 099300

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

- 1. Exterior Substrates:

- a. Steel.
 - b. Galvanized metal

- 2. Interior Substrates:

- a. Concrete masonry units (CMUs).
 - b. Steel.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for shop priming of exposed structural steel with primers specified in this Section.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications with primers specified in this section.
 - 3. Section 099113 "Exterior Painting" for general field painting.
 - 4. Section 099123 "Interior Painting" for general field painting.

1.03 DEFINITIONS

- A. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.

- B. Samples for Initial Selection: For each type of topcoat product indicated.

- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps 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: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 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.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 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 (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Corotech Coatings; Benjamin Moore & Co.
 - 3. International Protective Coatings; AkzoNobel.
 - 4. PPG Paints; PPG Industries, Inc.
 - 5. Sherwin-Williams Company (The).
 - 6. Tnemec Company, Inc.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Master Painters Institute (MPI) approved products list for the coating category indicated in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule at the end of this section.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: Match Architect's samples, as indicated by Basis of Design manufacturer's product designation in Finish Legend in Drawings.

PART 3 - EXECUTION

3.01 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. Masonry (CMUs): 12 percent.
 - 2. Gypsum Board: 12 percent.
- C. 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.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems 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 coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) at 6 to 12 inches (150 to 300 mm).
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- F. Non-primed Galvanized-Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical or chemical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.03 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.05 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel Substrates (Exposed Ribbon Support Structural Steel):
 - 1. Epoxy System:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.

- b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
- c. Topcoat: Epoxy, gloss, MPI #77.

B. Galvanized-Metal Substrates (Pipe Bollards Without Covers):

1. Pigmented Polyurethane over Vinyl Wash Primer and Epoxy Primer System:

- a. Prime Coat: Primer, vinyl wash, MPI #80.
- b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

3.06 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates (Welcome Center and Tucker Restroom Toilet Spaces):

1. Epoxy System:

- a. Block Filler: Block filler, epoxy, MPI #116.
- b. Intermediate Coat: Epoxy, matching topcoat.
- c. Topcoat: Epoxy, gloss, MPI #77.

B. Steel Substrates (Interior ladders):

1. Pigmented Polyurethane over Epoxy Zinc-Rich and Epoxy System:

- a. Prime Coat: Primer, zinc rich, epoxy, MPI #20.
- b. Intermediate Coat: Epoxy, gloss, MPI #77.
- c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

END OF SECTION 099600

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal plaques.

B. Related Requirements:

1. Section 101423.16 "Room-Identification Panel Signage" for plaques or signs similar to metal plaques, with or without frames, except that they are made of materials other than solid metal.
2. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
3. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
4. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.02 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.03 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 other installers, and accessories.
3. Show typestyles, graphic elements, including raised characters, and layout for each plaque at full size.

- C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

- D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Plaque Finish: Sample in base metal selected demonstrating metal finish and background texture and color.
2. Exposed Accessories: Full-size Sample of each accessory type.

- E. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

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

1.06 QUALITY ASSURANCE

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

1.07 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.
 - b. Deterioration of embedded graphic image.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 METAL PLAQUES

- A. Etched Plaque : Chemically etched or photochemically engraved metal sheet or plate with 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, provide products by one of the following:
 - a. A.R.K. Ramos.
 - b. Gemini Incorporated.
 - c. Masterwork Plaques.
 - d. United States Bronze.
 - 2. Plaque Material: Sheet stainless steel.
 - 3. Plaque Thickness: 0.250 inch (6.35 mm).
 - 4. Finishes:

- a. Integral Stainless Steel Finish: No. 4.
 - b. Overcoat: Manufacturer's standard baked-on clear coating.
5. Integral Edge Style: Square cut, polished.
 6. Mounting: Concealed studs.
 7. Text and Typeface: Typeface as selected by Architect from manufacturer's full range and variable content as scheduled below.
 - a. Content: Plaque will have the following content. Content to be confirmed with Owner at time of submittal of shop drawings.
 - 1) Clear Creek Welcome Center.
 - 2) Dedication month and year.
 - 3) Governor name and title
 - 4) Lieutenant Governor name and title.
 - 5) INDOT Commissioner name and title.
 - 6) Deputy commissioner name and title.
 - 7) District Commissioner name and title.
 - 8) Facilities Director name and title.
 - 9) IDOA Commissioner name and title.
 - 10) Public Works Director name and title.
 - 11) Civil Engineer.
 - 12) Architect.
 - 13) MEP Engineer.
 - 14) Landscape Architect.
 - 15) Contractor.

2.02 MATERIALS

- A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

2.03 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. Use concealed fasteners and anchors unless indicated to be exposed.
 2. Furnish stainless steel 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. Plaque Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

2.04 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. 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. Provide two lengths of standoffs as needed to install plaque plumb to floor on sloping wall. Drill and tap holes for required standoff fasteners. Fasteners shall not be exposed on face of plaque.

2.05 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.
- C. Directional Finishes: Run grain with long dimension of plaque.

2.06 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- 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.

3.02 INSTALLATION OF METAL PLAQUES

- 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. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
 - a. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.03 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 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

- 1. Panel signs.

- B. Related Requirements:

- 1. Section 101423.16 "Room-Identification Panel Signage" for room-identification signs that are directly attached to the building.
- 2. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
- 3. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
- 4. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
- 5. Section 265213 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.03 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.04 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.05 ACTION SUBMITTALS

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

- B. Shop Drawings: For panel 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 other installers, and accessories.

3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 1. Panel Signs: Full-size Sample.
 2. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.06 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

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

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.09 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. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and the State of Indiana Building Code.

2.02 PANEL SIGNS

- A. Panel Sign Trucker Restroom: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Seton Identification Products; a Brady Corporation company; Outdoor Aluminum Braille Restroom Sign.
 - 2. Solid-Sheet Sign: Aluminum [sheet and as follows:
 - a. Size: 8 inches high by 6 inches wide.
 - b. Thickness: 0.060 inch (1.52 mm).
 - c. Raised Graphics over Painted Background: Sign face etched or routed to receive powder coat enamel finish. Raised graphics and Braille brushed aluminum.
 - d. Color: Black.
 - 3. Provide Text: Provide signs with the listed text and handicap symbol for the following rooms. Verify text and layout with Owner prior to fabrication.
 - a. "Restroom".
 - 1) Trucker Restroom Buildings; Rooms 203, 204, 205, 303, 304, and 305.
 - b. "Women".
 - 1) Trucker Restroom Buildings; Room 202, 302.
- B. Panel Sign Confined Space: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated Aluminum-Sheet Sign: Vinyl printed graphics laminated to aluminum sheet..
 - a. Size: 10 inches high by 14 inches wide.
 - b. Composite-Sheet Thickness: 0.040 inch (1.02 mm).
 - c. Surface-Applied, Flat Graphics: Applied graphics and protective film.

- d. Text: "DANGER – PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER".
2. Mounting:
 - a. Trucker Restroom Signs: Projecting from wall 1/2 inch on stainless steel standoffs.
 - b. Confined Space Sign: Surface Mounted.
3. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.03 PANEL-SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
 1. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 2. Confined Space Sign: Exposed Metal-Fastener. I:
 - a. Through Fasteners: Stainless steel fasteners installed in predrilled holes in sign.
 - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-heads.
 3. Trucker Restroom Sign Mounting Fasteners:
 - a. Projecting Standoffs with Locked or Welded Studs: Threaded studs welded or locked to face button with sleeve spacer. Set in predrill holes in limestone with epoxy adhesive anchor material.

2.05 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.01 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. 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. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

3.03 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs 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 101423

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.
- B. Related Requirements:
 - 1. Section 101416 "Plaques" for one-piece, solid metal signs, with or without frames, that are used for high-end room-identification.
 - 2. Section 101423 "Panel Signage" for other signs not specified in this section.

1.03 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.04 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification 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 other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
 2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 3. Exposed Accessories: Full-size Sample of each accessory type.
 4. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.
- 1.06 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- 1.07 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For signs to include in maintenance manuals.
- 1.08 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.
- 1.09 QUALITY ASSURANCE
- A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.
- 1.010 FIELD CONDITIONS
- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.
- 1.011 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. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and the current Indiana Building Code.

2.02 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Acrylic Sheet Sign: acrylic face sheet with raised graphics with over subsurface graphics applied to back.
 - a. Composite-Sheet Thickness: 0.25 inch (6.35 mm).
 - b. Subsurface Graphics: vinyl graphic.
 - c. Color(s): As selected by Architect from manufacturer's full range.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition at Vertical Edges at Horizontal Edges: Square cut.
 - b. Corner Condition in Elevation: Square.
 - 3. Mounting: Manufacturer's standard method for substrates indicated with concealed anchors.
 - 4. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.03 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Sign Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.

- B. Adhesive: As recommended by sign manufacturer.

2.05 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies 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. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs 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. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

2.06 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

3.01 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. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. 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.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.02 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs 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.

3.03 SIGN SCHEDULE

A. Sign Type S1 (Room Signs)

1. Text: Provide signs with the listed text and Braille for the following rooms. Verify text and layout with Owner prior to fabrication.
 - a. Vending
 - 1) Room 109
 - b. Mechanical
 - 1) At the following doors, 106E, 107J, 109A, 112E, 113J, 119A, 122A
 - c. Vending Storage
 - 1) Room 117, one sign at each door.
 - d. Indiana State Police/INDOT
 - 1) Room 114, one sign at each door.
 - e. Office
 - 1) Room 104

B. Sign Type S2 (Toilet Room Signs)

1. Text: Provide signs with the listed text, Braille, and handicap symbol for the following rooms. Verify text and layout with Owner prior to fabrication.
 - a. Men
 - 1) Rooms 106 and 107
 - b. Women
 - 1) Rooms 107 and 113
 - c. Family Toilet / Cleaning Station
 - 1) Rooms 108 and 110.

C. Text Size: 1 inch.

D. Sign Size:

1. Sign Type S1: As required to accommodate text and Braille.
2. Sign Type S2: 8 inches high by 6 inches wide.

END OF SECTION 101423.16

SECTION 102420 - DECORATIVE PERFORATED METAL PANEL ASSEMBLY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes Work to be included in listed Allowance. General scope of this section is engineering, materials, fabrication, finishing and installation required for complete decorative perforated metal panel assembly ("Assembly"). Scope includes, but is not limited to, providing the following:
 - 1. Perforated aluminum metal panels, aluminum bow frames, supporting steel frame and connections to building structural steel.
 - 2. Structural engineering of panels, bow frames, and supporting steel frame. System engineer will provide anticipated loads to building engineer of record where assembly is connected to building structural steel at the predesigned points of connection (POC).
 - 3. Finishing panels, bow frames and supporting steel frame.
 - 4. Delivery to project site.
 - 5. Installation of Assembly.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for structural steel framing supporting Assembly.

1.03 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and approve location(s) for staging materials.
 - 2. Review erection procedures and schedule. Discuss methods to be used to protect completed work.
 - 3. Review work that can be installed at different points in schedule to minimize risk of damage to finish work.
 - 4. Review requirements for temporary bracing of structural steel frame and proposed points of support of bracing.

1.05 ACTION SUBMITTALS

- A. Product Data: Provide manufacturer's published product data for the following.
1. Perforated metal panels.
 2. Fasteners.
 3. Metal finishes.
- B. Calculations: Provide design calculations, sealed by an engineer registered in the State of Indiana, indicating the following.
1. Design loads (dead, live, snow, wind, seismic, and thermal).
 2. Forces in the panels, bow frames and supporting steel frame, the design of the bow frames, supporting steel frame and connections.
 3. Reactions for each load case at the points of connection to the building structure.
- C. The points of connection to the building are shown in the Drawings, with the assumed maximum load combination envelope reactions from the Assembly indicated in the Structural Drawings. The Assembly design shall be performed such that the reactions at the building anchorage points are within the specified values. If the specified maximum Assembly design reactions cannot be satisfied, the Manufacturer shall notify the Architect and Engineer-of-Record, and resolution to the design issues shall be met prior to the submittal of shop drawings.
- D. Shop Drawings: Show fabrication and installation details for Assembly.
1. Shop drawings shall be reviewed and stamped with review stamp by connection designer for conformance to their design prior to submitting for review.
 2. Include plans, elevations, sections, and attachment details.
 3. Indicate finish type and color for each Assembly component.
 4. Isometric details of typical connections between panel frames and bow frames, and bow frames and supporting structural steel framing.
 5. Indicate materials and profiles of each Assembly item, member, fittings, joinery, finish, fasteners, and accessory items.
 6. Include supporting steel frame and aluminum bow frame erection plans and framing elevations. Indicate shop and erection details including copes, connections, threaded fasteners, and welds.
 7. Erection plans shall clearly denote locations of all connections which require field welds or slip critical bolts.
 8. Steel Bolts and Connectors: Indicate proposed grade and material types for bolts, anchor rods, nuts and washers as defined by ASTM F3125/F3125M.
 - a. Point of connection design provides plates bored for 3/4" diameter bolts. Identify locations Assembly design requires bolts other than 3/4" diameter ASTM F3125/F3125M Grade A325 (Grade A325M).
 9. Welds: Use standard AWS symbols for welds, indicating size, length and type. Distinguish between shop and field welds. Provide prequalified weld designations and appropriate details including root opening dimensions, bevel properties and access hole dimensions for complete joint penetration and partial joint penetration groove welds.
 - a. Welding Electrodes: Submit certification welding electrodes and rods comply with AWS requirements.
- E. Samples for Initial Selection: For products involving selection of color, texture, or design.

F. Samples for Verification:

1. For each type of exposed finish required in manufacturer's standard sizes.
2. Welded connections.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.

1.07 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- B. Sample Panel: Prepare unfinished sample assembly that includes four 18 inch by 18 inch panels with proposed frame extrusions. Mount panels to a minimum of one sample bow frame.
 1. Purpose of sample panel is to establish workmanship of components prior to application of finish, confirmation of expansion provisions, test proposed connection methods, and verify assembly approach proposed in approved shop drawings.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockups of assembly as agreed to and indicated on approved Shop Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components so as not to be damaged or deformed. Crate and package assembly components for protection during transportation and handling. Coordinated delivery of components with the progress of the work to minimize duration of on site storage. Clearly mark packaging to designate location of components in final assembly.
- B. Store components on paved surfaces or concrete slabs away and protected from vehicular traffic. Storage of components on earthen or gravel surfaces is not permitted.
- C. Unload, store, and erect assembly in a manner to prevent bending, warping, twisting, and surface damage.
- D. Stack assembly components per design of crating and packaging, raised on platforms or pallets and covered with suitable weathertight and ventilated covering. Store components to ensure dryness, with positive slope for drainage of water under raised platforms/pallets.
- E. Do not store components in contact with, or adjacent to, other stored materials which might cause staining, denting, or other surface damage.

- F. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping. Retain strippable protective coverings until completion of assembly installation.

1.09 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of points of connection and other contiguous construction by field measurements before fabrication.

1.010 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of decorative perforated metal panel assembly 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 or permanent deflection resulting from pressures within the design criteria.
- b. Noise or vibration created by thermal and structural movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

- 2. Warranty Period: Ten years from date of Substantial Completion.

- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- 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

- 2.01 Decorated Perforated Metal Panel Assembly will be provided as part of listed Allowance. Manufacturer of assembly will be selected by the Owner.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design Assembly, including attachment to building construction.

- B. Structural Performance: Decorative perforated metal panel assembly, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Wind Loads:
 - a. Specific component design wind pressures shall be calculated by supplier's engineer based on ASCE 7-10 Ch. 30 Wind Loads – Components and Cladding, for wall and parapet type conditions of Metal Panel Assembly which are applicable based on the component location relative to the building roof level.
 - b. Metal Panel Assembly wind load reactions to building connection points shall be calculated by the supplier's engineer based on ASCE 7-10 Ch. 27 Wind Loads on Buildings-MWFRS (Directional Procedure), for wall and parapet type conditions which are applicable based on the Assembly location relative to the building roof level.
 2. Snow Loads: As indicated in Drawings.
 3. Deflection: Design assembly to limit deflection in the assembly to the following.
 - a. The deflection of supporting steel frame shall not exceed:
 - 1) L/240 between adjacent bow frames.
 - 2) L/175 or 1 inch over entire span.
 - b. The deflection of aluminum bow frames shall not exceed L/175 or 3/4" whichever is less.
 - c. The deflection of aluminum panels shall not exceed L/60 of the length or width.
 - d. No permanent deformation in the panel system or its individual components under design loads.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.03 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Metal components defined in this section may not represent all metal elements Manufacturer may propose for the design. Identify standards met by products proposed for use in the Assembly but not included in this specification.

2.04 ALUMINUM

- A. Source Limitations: Obtain each aluminum component from single source from single manufacturer.

- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- C. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.
- D. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- E. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
- F. Plate and Sheet: ASTM B209 (ASTM B209M), 3003-H14.
- G. Perforated Panels: Aluminum sheet, ASTM B209 (ASTM B209M), Alloy 3003-H14, 0.190 inch (4.826 mm) thick, with approximately 1/4-inch (6.4-mm) holes creating 30 percent or greater open area pattern. Final hole size and pattern to be selected by Architect and Owner.
 - 1. Design intent is to fabricate panels from fully perforated sheets (no border required).

2.05 STEEL

- A. Source Limitations: Obtain steel components from single source from single manufacturer.
- B. Tubing: ASTM A500/A500M (cold formed).
- C. W-Shapes: ASTM A992/A992M.
- D. Channels, Angles, M-Shapes, Plates, Bars: ASTM A36/A36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- F. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
 - 1. Finish: Black

2.06 FASTENERS

- A. Fastener Materials:
 - 1. Fasteners for Aluminum Components: Aluminum or Type 304 stainless steel fasteners.
 - 2. Fasteners for Steel to Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Fasteners for Dissimilar Metal Components: Type 304 stainless steel fasteners.
 - 4. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring to other types of construction and capable of withstanding design loads.

- C. Provide concealed fasteners unless otherwise indicated or as indicated, noted, and approved in approved shop drawings.
 - 1. Provide square or hex socket flat-head machine screws for exposed panel fasteners unless otherwise indicated.

2.07 MISCELLANEOUS MATERIALS

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

2.08 FABRICATION

- A. Fabricate Assembly 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. Shop assemble components to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. 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.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

- H. Welded Connections for Aluminum: Fabricate Assembly to interconnect aluminum members with concealed internal welds that eliminate surface grinding.
- I. Perforated-Metal Panels: Fabricate infill panels from perforated metal made from aluminum.
 - 1. Edge panels with aluminum custom die perimeter extrusion(s) with 0.625 inch deep channel that engages panel edge, strengthens panel, and provides connection points for hardware to connect panel to bow frames.
 - a. Miter corners of perimeter extrusion(s).
 - b. Weld perimeter extrusion(s) to back of panel prior to forming and finishing panel.
 - c. Design perimeter extrusions to permit panel be fastened to bow frames with clips and fasteners concealed behind panels.
 - 2. Orient perforation pattern and roll perforated metal panels along lines indicated in Drawings.

2.09 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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. Provide exposed fasteners with finish matching appearance of adjacent materials.

2.010 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (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.
 - 1. Color and Gloss: Two colors of panels and a third framing color as selected by Architect from manufacturer's full range.

2.011 STEEL FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
- B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime steel with primers specified in Section 099600 "High-Performance Coatings" indicated.

- C. Shop Applied High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with erector present, elevations and locations of points of connection to building structural steel framing. Verify bolt hole diameter and location match those of approved shop drawings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install Assembly in accordance with manufacturer's written instructions with orientation, sizes and locations indicated in approved Shop Drawings. Install components securely in place, with provisions for thermal and structural movement.
- B. Do not install component parts that are defective, including warped, bowed, dented, abraded, and broken components. Coordinate replacement or repair of such components with manufacturer.
- C. Do not weld, cut, or abrade surfaces of Assembly components that have been coated or finished after fabrication and are designed for field connection without further cutting or fitting.
- D. Perform final fitting required for installation of Assembly.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install components without distortion, warp, or rack.
 - 3. Separate dissimilar metals with non-conductive materials to prevent corrosion or electrolytic action.

3.03 ATTACHING STRUCTURAL STEEL FRAME TO BUILDING STRUCTURE

- A. Metal Panel Assembly shall be connected to the building structure only at the points indicated for connections. Reactions calculated by the Assembly design engineer shall not exceed the load criteria indicated on the Drawings.
- B. Remove temporary bracing upon completing of support steel frame erection and connections to building structure.

3.04 ATTACHING BOW FRAMES

- A. Attach bow frames to supporting structural steel frame, establishing lines and layout for Assembly indicated in manufactures approved shop drawings and tolerances established by delegated design engineer.
- B. Attach horizontal frame members between bow frames to maintain lines of Assembly and within established tolerances for panel connections.

3.05 ATTACHING PANELS

- A. Conform to panel fabricator's approved detailing for installation using concealed fasteners to connect panel to clips and clips to bow frames.

3.06 INSTALLATION TOLERANCES

- A. Shim and align panel units within installed tolerances of 1/4 inch in 20 feet, non-cumulative, on slope and location lines indicated in approved Shop Drawings.
- B. Align and connect components with a maximum 1/16 inch offset between adjoining faces of matching profiles

3.07 REPAIR

- A. Touchup Painting:
 - 1. Touchup Painting for Structural Steel Frame: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099600 "High-Performance Coatings."

3.08 CLEANING

- A. Clean Assembly by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.09 PROTECTION

- A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion or within conditions established by manufacturer, whichever occurs first.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return components that cannot be refinished in the field to the shop; make required alterations and refinish entire component, or provide new components.

END OF SECTION 057300

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Public-use washroom accessories.
 2. Hand dryers.
 3. Childcare accessories.

1.02 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 masonry as required to prevent delaying the Work.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 3. Include electrical characteristics.
- B. Samples: For each exposed product and for each finish specified, full size.
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 accessories using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.05 CLOSEOUT SUBMITTALS

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

1.06 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist 250 lbf (1112 N) applied in any direction and at any point.

2.02 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
 - 1. Provide listed basis-of-design product or a comparable product from the following manufacturer.
 - a. Bradley Corporation.
- B. Toilet Tissue (Roll) Dispenser T10:
 - 1. Basis-of-Design: Bobrick B-274.
 - 2. Description: Double-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Eccentric-shaped, molded-plastic spindle revolves one-half revolution per dispensing operation for controlled delivery; core cannot be removed until roll is empty.

5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
6. Material and Finish: Satin-finish aluminum bracket with plastic spindle.

C. Waste Receptacle T11:

1. Basis-of-Design: Bobrick B-43644
2. Mounting: Open top, recessed.
3. Minimum Capacity: 12.8 Gallons.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Liner: Molded plastic retainer with stainless steel u-shaped support straps for disposable trash liners.

D. Grab Bar T1, T2, and T3:

1. Basis-of-Design product: Bobrick B-6806
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

E. Sanitary-Napkin Disposal Unit T9:

1. Basis-of-Design: Bobrick B-35303
2. Mounting: Recessed.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Mirror Unit T4:

1. Basis-of-Design Product: Bobrick B-290.
2. Frame: Stainless steel angle, 0.05 inch (1.3 mm) thick.
 - a. Corners: Welded and ground smooth.
3. Size: 24 inches wide by 36 inches high.
4. Hangers: Manufacturer's standard rigid, tamper- and theft-resistant.

G. Coat Hook T5:

1. Basis-of-Design: Bobrick B-9542.
2. Description: Single-prong solid machined unit.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

H. Folding Shower Seat T14:

1. Basis-of-Design: Bobrick B-5181.
2. Configuration: L-shaped seat, designed for wheelchair access.

3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: 33 inches wide with 14 inch deep seat with 13 inch wide by 21 inch deep end.

2.03 HAND DRYERS

- A. Source Limitations: Obtain hand dryers from single source from single manufacturer.
- B. High-Speed Air Dryer T6:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Excel Dryer Inc.; XLERATOR® Hand Dryer or a comparable product by one of the following:
 - a. Bobrick Washroom Equipment, Inc.; InstaDry Surface Mounted Automatic Hand Dryer
 - b. Bradley Corporation.; Aerix + High Speed Hand Dryer
 - c. World Dryer Corporation (Formerly American Dryer), Extreme Air .
 2. Description: High-speed, warm-air hand dryer for rapid hand drying.
 3. Mounting: Surface mounted.
 - a. Protrusion Limit: Installed unit protrudes maximum 4 inches (102 mm) from wall surface.
 4. Operation: Infrared-sensor activated with timed power cut-off switch.
 - a. Average Dry Time: 12 seconds.
 - b. Automatic Shut Off: At maximum of 40 seconds.
 5. Maximum Sound Level: 65 dB.
 6. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 7. Electrical Requirements: 115 V, maximum 13 A, maximum 1500 W.

2.04 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain each type of childcare accessory from single source from single manufacturer.
- B. Diaper-Changing Station T15:
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Pluie UV Diaper Changing Table.
 2. Description: Horizontal unit that opens by folding down from stored position and with retractable child-protection strap and UV-C light sanitizing system.
 - a. Engineered to support minimum of 150 pound (68 kg) static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches (102 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish:
 - a. Panels: Thermoformed and injection molded polycarbonate and ABS plastic.
 - b. Cushion: Polyurethane.
 - c. Frame, Handle & Hinges: Stainless steel.
 - d. Wall Bracket: Steel.
 - e. UV light Protective Panel: Fused Silica.
6. Power Requirements: 120 volt, single phase, 1 amp maximum current.
7. Warranty: Five years.

2.05 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- (0.9-mm-) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.06 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.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with 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.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.02 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.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed- or surface-mounting method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.05 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.02 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide J. L. Industries, Inc.; Activar Construction Products Group, Inc.; Ambassador Duo-1015-V10, or a comparable product by one of the following:
 - a. Larsen's Manufacturing Company.
 - b. Nystrom, Inc.
 - c. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel sheet .
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color:
 - a. Clear transparent acrylic sheet.
- 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 lever handle with cam-action latch.
 - 2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.

J. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
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 cabinet door.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Black.
 - 4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: White.
2. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), manufacturer's standard thickness, with Finish 1 (smooth or polished).

2.03 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. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. 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 per manufacturer's standard for cabinet model indicated.
 2. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 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. Finish fire-protection cabinets after assembly.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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

3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated below.
 - 1. Fire-Protection Cabinet Mounting Height: 48 inches (1219 mm) above finished floor to top of fire extinguisher cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.04 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

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes portable, wheeled fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.02 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.

1.03 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.05 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.06 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 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.02 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, provide products by one of the following:
 - a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Nystrom, Inc.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container (At locations marked "FE" and "FEC" in Drawings):: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.03 MOUNTING BRACKETS (At locations marked FE in Drawings)

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
 - 1. Mounting Height: Top of fire extinguisher to be at 42 inches (1067 mm) above finished floor.

END OF SECTION 104416

SECTION 105613 - METAL STORAGE SHELVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Four-post metal storage shelving.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage.
- B. Samples for Initial Selection: For units with factory-applied color finishes. Include similar Samples of accessories involving color selection.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal storage to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Shelves: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than two shelves.
 - 2. Shelf-to-Post Connectors: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 connectors.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain metal storage from single source from single manufacturer.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install metal storage until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating.
- D. Steel Tubing: ASTM A 513, Type 2.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT-304.
- F. Steel Wire: ASTM A 899.
- G. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
- H. Floor Anchors: Galvanized-steel, post-installed expansion anchors. Provide number per unit recommended by manufacturer unless additional anchors are indicated in calculations.
- I. Wall Anchors: Manufacturer's standard, galvanized-steel anchors designed to secure metal storage shelving to adjacent wall. Provide (2) per shelving unit, one at each top corner, per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.
- J. Shims: Korolath plastic shims, provided in various thicknesses, nominal 2 inches (50 mm) square.

2.02 FOUR-POST METAL STORAGE SHELVING

- A. Open Four-Post Metal Storage Shelving: Factory-formed, field-assembled, freestanding system, designed for shelves to span between and be supported by corner posts, with shelves adjustable over the height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units similarly, so each unit is independent. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Lyon Workspace Products, LLC. 2000 series (angle posts) Shelving or comparable product by one of the following:
 - a. Penco Products, Inc.

- b. Republic Storage Systems, Co.
 - c. Rousseau.
2. Size: 48 inches wide by 18 inches deep by 85 inches tall.
 3. Maximum Load-Carrying Capacity per Shelf: 550 pounds.
 4. Posts: Fabricated from hot-rolled steel; in manufacturer's standard shape; with perforations at 1-1/2 inches (38 mm) o.c. to receive shelf-to-post connectors.
 - a. Steel Thickness, Nominal: As required for load-carrying capacity per shelf and number of shelves.
 - b. Post Base: Adjustable steel floor plate, drilled for floor anchors.
 5. Bracing: Manufacturer's standard, double diagonal cross bracing at back and ends; as required for stability, load-carrying capacity of shelves, and number of shelves.
 6. Solid-Type Shelves: Fabricated from steel sheet as follows:
 - a. Steel-Sheet Thickness: As required for load-carrying capacity per shelf.
 7. Shelf Quantity: Five.
 8. Shelf-to-Post Connectors: Manufacturer's standard connectors.
 9. Base: Open, with exposed post legs.
 10. Finish: Baked enamel or powder coat.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.03 FABRICATION

- A. Shop Fabrication: Prefabricate shelving components in shop to greatest extent possible to minimize field fabrication; temporarily preassemble shelving components where necessary to ensure that field-assembled components fit together properly. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate metal storage shelving square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
 2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 3. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 4. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- C. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a 1/2-inch- (13-mm-) wide hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch (0.8 mm). Shear and punch metals cleanly and accurately. Remove burrs.

- E. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.

2.04 GENERAL FINISH REQUIREMENTS

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

2.05 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for completion of applied finishes and suitable conditions where metal storage shelving will be installed.
- C. Examine walls to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Vacuum finished floor and wet mop resilient flooring over which metal storage shelving is to be installed.

3.03 INSTALLATION

- A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.

1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
3. Adjust post-base bolt leveler to achieve level and plumb installation.
4. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate with stainless steel or "Korolath" shims to achieve level and plumb installation.
5. Install shelves in each shelving unit at equal spacing.
 - a. Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.

3.04 ERECTION TOLERANCES

- A. Erect four-post metal storage shelving to a maximum tolerance from vertical of 1/2 inch (13 mm) in up to 10 feet (3 m) of height, not exceeding 1 inch (25 mm) for heights taller than 10 feet (3 m).

3.05 ADJUSTING

- A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.
- B. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- C. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105613

SECTION 125700 – INDUSTRIAL FURNITURE (WORKBENCH)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes industrial furniture workbenches with the following components:
 - 1. Open panel leg support.
 - 2. Modular drawer end cabinet.
 - 3. Laminated fiberboard and particle board workbench tops.

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification sections.
- B. Product data for each type of industrial furniture assembly specified, including manufacturer's product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop drawings showing installation of industrial furniture assembly including plans, elevations, sections, details of components, and attachments to other units of work.
- D. Samples for initial selection purposes in the form of manufacturer's color charts, actual units, or sections of units showing full range of colors for each item of industrial furniture indicated.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain industrial furniture specified in this section from one source from a single manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products specified in Schedule at end of Part 3 of this Section from one of the following manufacturers:
 - 1. Lyon Metal Products
 - 2. Penco Products, Inc.
 - 3. Republic Storage Systems Company

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 366, matte finish, suitable for exposed applications, and stretcher-leveled or roller-leveled to stretcher-leveled flatness.
- B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.03 METAL WORKBENCHES

- A. Bench size: Minimum of 72 inches wide by 34 inches deep. Bench top adjustable from 30 to 34 inches above floor.
- B. Panel Leg Assembly: Form panel leg assembly from steel sheet. Comply with the following:
 - 1. Panel Leg Assembly: Minimum 0.0747 inch thick steel channel assembly with two channel legs connected by top and bottom channel rails. Top rail punched to receive top and side stops. Bottom rail punched to receive shelf.
 - 2. Adjustable height leg sleeve: Minimum 0,0747 inch thick steel channel punched to receive footplate and to allow multiple bench heights.
 - 3. Stringer: Minimum 0.0478 inch thick steel channel, minimum of 5 inches high with two deep formed ribs. Punched for attachment to legs.
 - 4. Shelf: Minimum 0.0478 inch thick with 1-1/2 inch front and rear faces and 1 inch return flange at bottom of faces. Depth of shelf minimum of 12 inches. Shelf assembly punched to bolt to legs and drawer cabinet.
- C. Four Drawer Cabinet Assembly: Form drawer assembly from steel sheet. Comply with the following:
 - 1. Drawer Pedestal: Provide individual drawer assemblies bolted one to the other to form pedestal or single 4-drawer cabinet.
 - 2. Drawers: Minimum 0.0359 inch thick steel, suspended on four nylon rollers within their own complete welded drawer case (back and bottom of case is open). Each drawer to be lockable. Drawer fronts-to include 6-inch recessed pull.
 - 3. Drawer Assembly width: Nominal 22"
 - 4. Drawer Lock: Groove keys, 2 keys each, locks keyed different, 200 key changes, masterkeyed, clip mounted.
- D. Wood Laminated Top: Resin hardboard laminated to top and bottom of particle board core. Provide perimeter hardwood edge band, minimum thickness of 1/2 inch. Finish top, bottom, and edges with two coats of polyurethane varnish.
 - 1. Back Stop: Minimum 0.0478 inch thick steel fabrication pre-punched for attachment to bench top.
 - 2. Side Stop: Minimum 0.0478 inch thick steel fabrication pre-punched for attachment to back stop, bench top and leg assembly. Taper side stop down from height of back stop at back to front of bench top.

2.04 FABRICATION

- A. Knocked-Down Construction: Fabricate workbenches for nominal assembly at Project site.
- B. Fabricate workbenches square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Assemble frame members together to form a rigid, one-piece assembly.
 - 1. Form workbench panels, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.

2.05 FINISHES, GENERAL

- A. Finish all steel surfaces and accessories, except chrome-plated surfaces.
- B. Comply with NAAMM's "Metal Finished Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are 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.

2.06 STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
- B. Baked-Enamel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.4 mils on doors, frames, and legs, and 1.1 mils elsewhere.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal workbenches and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.
- B. Assemble knocked-down workbenches with standard fasteners, with no exposed fasteners on door faces and face frames.
- C. Anchor workbenches to floors at intervals recommended by manufacturer. Install anchors

through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

- D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

3.02 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust drawers and locks to operate easily without binding. Verify that integral locking devices operate properly.
- B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous-metal surfaces.
- C. Protect workbenches from damage, abuse, dust, dirt, stain, or paint. Do not permit workbench use during construction.
- D. Touch up marred finishes, or replace workbench units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by workbench manufacturer.

3.03 WORKBENCH SCHEDULE

- A. Workbench: Where workbench is indicated in Drawings, provide unit complying with the following:
 - 1. Leg Assembly: Open leg assembly with one four drawer cabinet assembly.
 - 2. Top: Wood Laminated Top
 - 3. Height of Top: 34 inches
 - 4. Size of Top: 72 x 34 inches

END OF SECTION 125700